9 CBSE

ARTIFICIAL INTELLIGENCE

CODE 417 | Skill Education

Name: .....

Class: ..... Section: ..... Roll No: .....

School: .....

Favourite Tech: .....

Ver. 3.0

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PREFACE

"A year spent in artificial intelligence is enough to make one believe in God."

— Alan Perlis

Artificial Intelligence is the most talked-about subject and we all understand that the future lies in knowing it well. It is a branch of Computer Science that simulates human intelligence into machines, especially in computer systems, so that they can think and perform actions similar to humans.

Touchpad Artificial Intelligence series has some salient features such as **AI Reboot, AI Deep Thinking, AI in Life, AI Lab** and **AI Ready** which ensures that **NEP 2020 & NCF 2023** guidelines are followed. The series is written keeping in mind about the future and scope that lies in Artificial Intelligence. The knowledge is spread in a phased manner so that no student, irrespective of age, has difficulty understanding the theory.

There are some brainstorming activities in the form of **AI Task** in between the topics to ensure that students give pause to their learning and use their skills to reach to some creative ideas in solving given problems. Every chapter has competency-based questions as guided by CBSE to ensure that students are capable of applying their learning to solve some real-life challenges. There are plenty of **Video Sessions** for students and teachers to go beyond the syllabus and enrich their knowledge.

We would like to humbly acknowledge the support provided by our family, friends and Orange Education team to accomplish this noble task.

We are sure that this book will prove to be a tool in making the students future ready for Artificial Intelligence.

Wishing learners great success in future endeavours. Enjoy the journey of happy learning!!

All your feedback and suggestions will always be wholeheartedly welcome to improve and grow.

— Authors

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INSIDE THE SERIES

The key features of the series have been designed to ensure better learning and assessment.

Learning Resources

Learning Outcomes:
It provides an overview of the unit/chapter contents.

Brainy Fact:
It presents an interesting fact relevant to the topic or the chapters.

AI Game:
It contains an interesting game or activity for the students to try on their own or with their classmates to learn how the game mechanics work while having fun.

At a Glance:
This section provides a summary of the chapter.

Ice Breaker Activity:
This section allows students to familiarise with the concept with the help of an activity.

Video Session:
This section contains a link of the video related to the topic for better understanding of the concept.

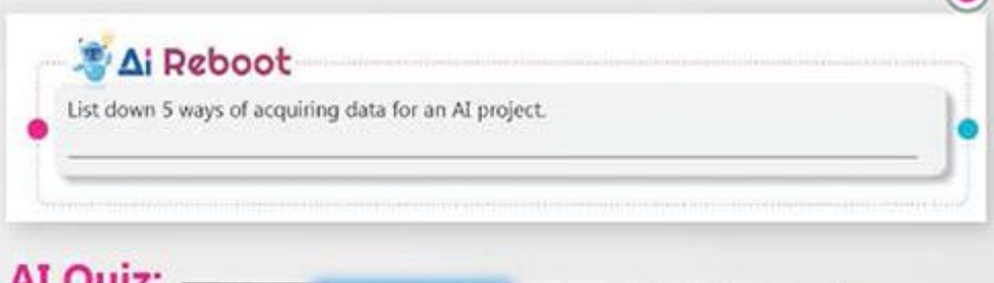
AI Glossary:
This section contains definition of important AI terms.

AI Innovators:
It presents information about the pioneers in the field of AI.

Assessment Resources

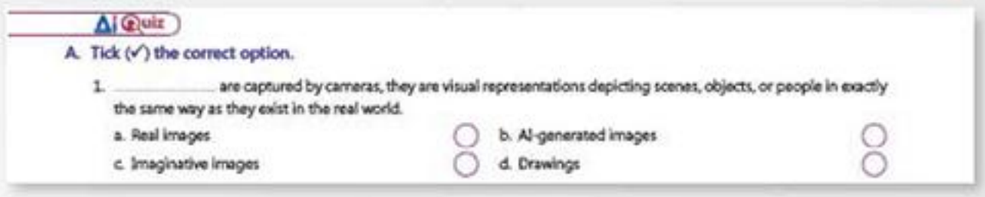
AI Reboot:

It presents questions to the students to access their current progress in the ongoing topic.



AI Quiz:

It contains MCQs for the students to test and improve their mental dexterity.



Exercise:

It contains a variety of questions to assess the concepts taught in the unit/chapter.

AI Ready:

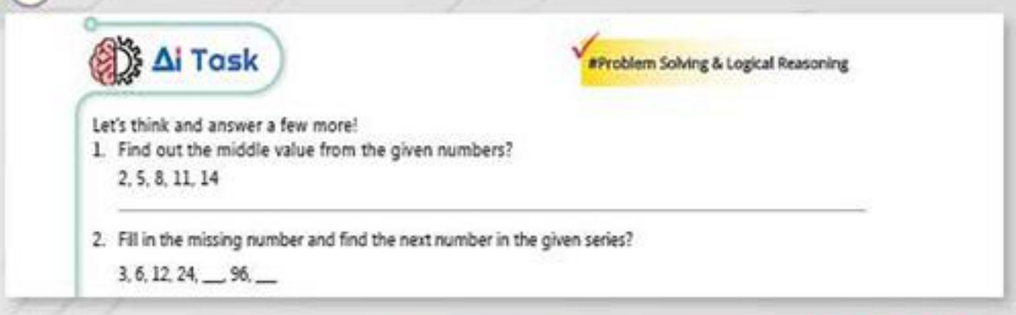
It contains an assessment for the students to analyse their progress towards acquired AI-readiness skills.

Projects:

It helps the students work outside the classroom environment while improving their practical skills.

AI Task:

It provides an activity to the students allowing them to research and learn new things.



AI in Life:

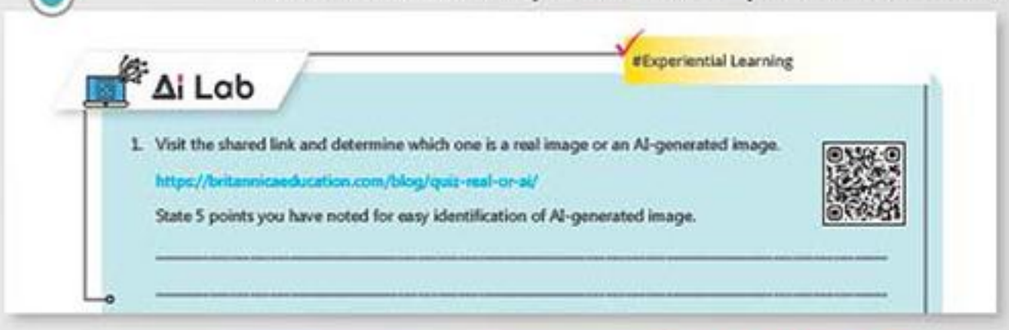
It presents questions that promotes the moral growth and experiential learning.

AI Deep Thinking:

It presents a question/scenario in which the students are required to think deeply and apply their knowledge.

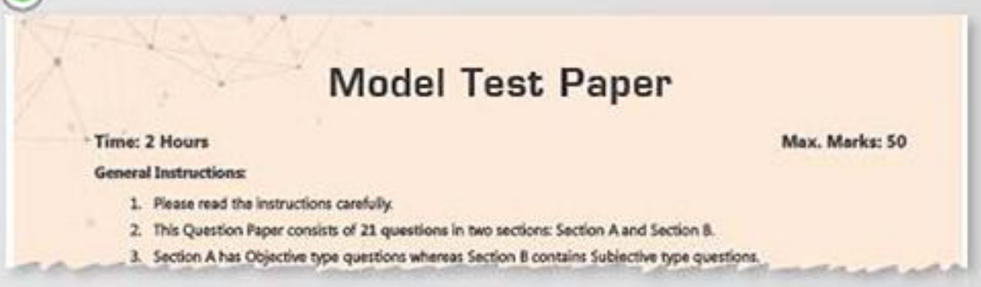
AI Lab:

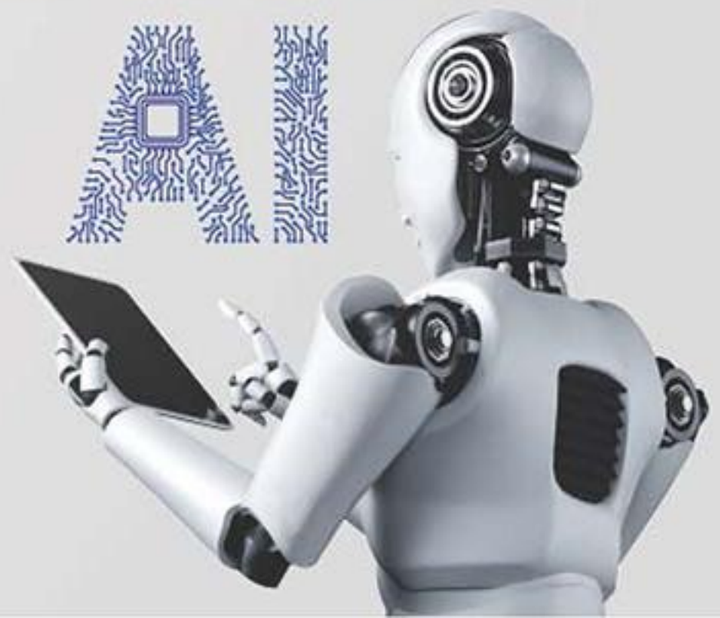
It contains questions that help the students to improve their practical skills.



Model Test Paper:

It contains CBSE based model test paper.





ARTIFICIAL INTELLIGENCE (SUBJECT CODE 417)
CLASS – IX

Total Marks: 100 (Theory-50 + Practical-50)

OBJECTIVES OF THE COURSE:

The objective of this module/curriculum - which combines both Inspire and Acquire modules is to develop a readiness for understanding and appreciating Artificial Intelligence and its application in our lives. This module/curriculum focuses on:

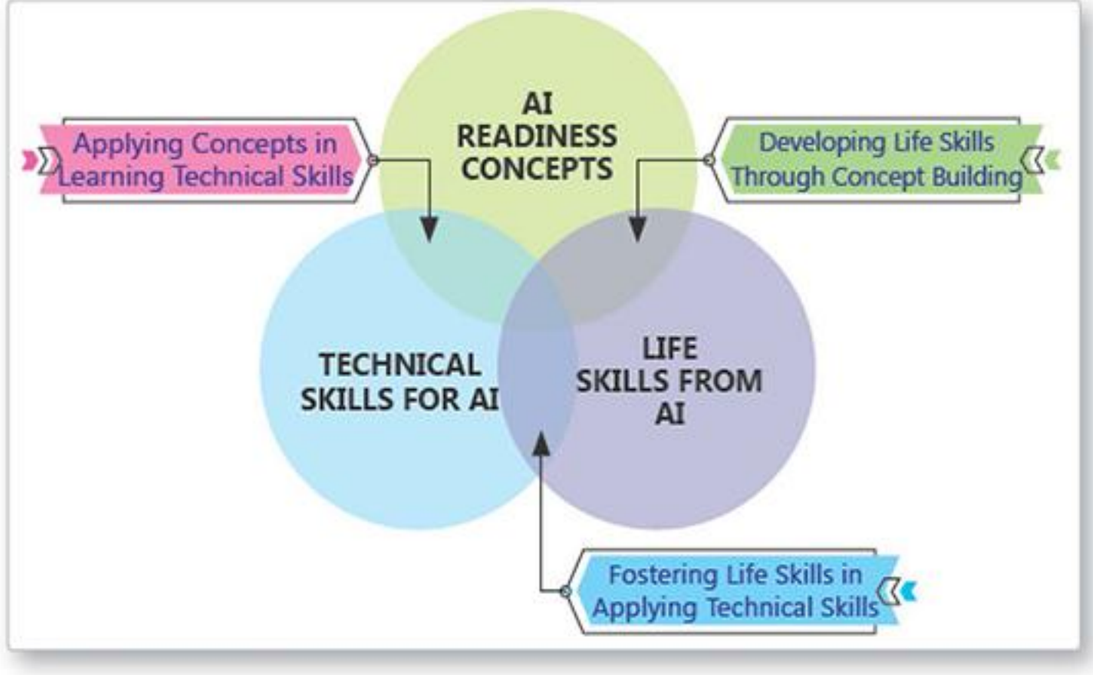
1. Helping learners understand the world of Artificial Intelligence and its applications through games, activities and multi-sensorial learning to become AI-Ready.
2. Introducing the learners to three domains of AI in an age-appropriate manner.
3. Allowing the learners to construct the meaning of AI through interactive participation and engaging hands-on activities.
4. Revisiting AI domains, project cycle and Ethics
5. Introducing the learners to the importance of Math for AI, data literacy and generative AI
6. Introducing the learners to programming skills - Basic python coding language.

LEARNING OUTCOMES:

Learners will be able to:

1. Identify and appreciate Artificial Intelligence and describe its applications in daily life.
2. Relate, apply and reflect on the Human-Machine Interactions to identify and interact with the three domains of AI: Data, Computer Vision and Natural Language Processing and Undergo assessment for analysing their progress towards acquired AI-Readiness skills.
3. Imagine, examine and reflect on the skills required for futuristic job opportunities.
4. Unleash their imagination towards smart homes and build an interactive story around it.
5. Understand the impact of Artificial Intelligence on Sustainable Development Goals to develop responsible citizenship.
6. Research and develop awareness of skills required for jobs of the future.
7. Gain awareness about AI bias and AI access and describe the potential ethical considerations of AI.
8. Develop effective communication and collaborative work skills.
9. Get familiar and motivated towards Artificial Intelligence and Identify the AI Project Cycle framework.
10. Learn problem scoping and ways to set goals for an AI project and understand the iterative nature of problem scoping in the AI project cycle.
11. Brainstorm on the ethical issues involved around the problem selected.
12. Foresee the kind of data required and the kind of analysis to be done, identify data requirements and find reliable sources to obtain relevant data.
13. Use various types of graphs to visualize acquired data.
14. Understand types of modelling.
15. Understand the importance of Math for AI.
16. Learn the concept of data literacy and generative AI
17. Acquire introductory Python programming skills in a very user-friendly format.

SKILLS TO BE DEVELOPED



SCHEME OF STUDIES:

This course is a planned sequence of instructions consisting of units meant for developing employability and vocational competencies of students of Class IX opting for skill subject along with other education subjects.

The unit-wise distribution of hours and marks for class IX is as follows.

	UNITS	NO. OF HOURS for Theory and Practical		MAX. MARKS for Theory and Practical
PART A	**Employability Skills**			
	Unit 1: Communication Skills-I	10		2
	Unit 2: Self-Management Skills-I	10		2
	Unit 3: ICT Skills-I	10		2
	Unit 4: Entrepreneurial Skills-I	15		2
	Unit 5: Green Skills-I	05		2
	Total	**50**		**10**
PART B	**Subject Specific Skills**			
		Theory	**Practical**	
	Unit 1: AI Reflection, Project Cycle and Ethics	30	25	10
	Unit 2: Data Literacy	22	28	10
	Unit 3: Math for AI (Statistics & Probability)	12	13	07
	Unit 4: Introduction to Generative AI	08	12	05
	Unit 5: Introduction to Python	01	09	08
	Total	**160**		**40**
PART C	**Practical Work**			
	Unit 5: Introduction to Python **Practical File (minimum 15 programs)**			15
	Practical Examination • Simple programs using input and output function • Variables, Arithmetic Operators, Expressions, Data Types • Flow of control and conditions • Lists * ***Any 3 programs based on the above topics***			15
	Viva Voce			5
	Total			**35**
PART D	**Project Work / Field Visit / Student Portfolio** * ***relate it to Sustainable Development Goals***			15
	Total			**15**
	GRAND TOTAL	**210**		**100**

EMPLOYABILITY SKILLS

UNIT	LEARNING OUTCOMES	THEORY	PRACTICAL
COMMUNICATION SKILLS –I	1. Demonstrate knowledge of various methods of communication	1. Methods of communication • Verbal • Non-verbal • Visual	1. Writing pros and cons of written, verbal and non-verbal communication 2. Listing do's and don'ts for avoiding common body language mistakes
	2. Identify elements of communication cycle	1. Meaning of communication 2. Importance of communication skills 3. Elements of communication cycle– (i) sender, (ii) ideas, (iii) encoding, (iv) communication channel, (v) receiver, (vi) decoding, and (vii) feedback	1. Draw a diagram of communication cycle 2. Role plays on communication process related to the sector/job role
	3. Identify the factors affecting our perspectives in communication	1. Perspectives in communication 2. Factors affecting perspectives in communication • Visual perception • Language • Past experience • Prejudices • Feelings • Environment	1. Group discussion on factors affecting perspectives in communication 2. Sharing of experiences on factors affecting perspectives 3. Sharing experiences on factors affecting communication at workplace
	4. Demonstrate the knowledge of basic writing skills	1. Writing skills related to the following: • Phrases • Kinds of sentences • Parts of sentence • Parts of speech • Use of articles • Construction of a paragraph	1. Demonstration and practice of writing sentences and paragraphs on topics related to the subject
SELF-MANAGEMENT SKILLS – I	1. Describe the meaning and importance of self-management	1. Meaning of self-management 2. Positive results of self-management 3. Self-management skills	1. Identification of self-management skills 2. Strength and weakness analysis
	2. Identify the factors that helps in building self-confidence	1. Factors that help in building self-confidence– social, cultural, and physical factors 2. Self-confidence building tips– getting rid of the negative thoughts, thinking positively, staying happy with small things, staying clean, hygienic and smart, chatting with positive people, etc.	1. Role play exercises on building self-confidence 2. Use of positive metaphors/ words 3. Positive stroking on wakeup and before going bed 4. Helping others and working for community
ICT SKILLS - I	1. Describe the role of Information and Communication Technology (ICT) in day-to-day life and workplace	1. Introduction to ICT 2. Role and importance of ICT in personal life and at workplace 3. ICT in our daily life (examples) 4. ICT tools– Mobile, tab, radio, TV, email, etc.	1. Discussion on the role and importance of ICT in personal life and at workplace 2. Preparing posters/collages for showing the role of ICT at workplace
	2. Identify components of basic computer system and their functions	1. Computer system– Central Processing Unit (CPU), memory, motherboard, storage devices 2. Hardware and software of a computer system 3. Role and functions of Random Access Memory (RAM) and Read Only Memory (ROM) 4. Role and functions of Central Processing Unit 5. Procedure for starting and shutting down a computer	1. Connecting the cables and peripherals to the Central Processing Unit 2. Starting and shutting down a computer 3. Group discussion on the various aspects of hardware and software
	3. Demonstrate use of various components and peripherals of computer system	1. Peripherals devices and their uses– mouse, keyboard, scanner, webcam, etc. of a computer system	1. Identification of various parts and peripherals of a computer 2. Demonstration and practice on the use of mouse 3. Demonstration and practice on the use of keyboard 4. Demonstration of the uses of printers, webcams, scanner and other peripheral devices 5. Drawing diagram of computer system and labelling it
	4. Demonstrate basic computer skills	1. Primary operations on a computer system– input, process, storage, output, communication networking, etc.	1. Identification of the various input and output units and explanation of their purposes

UNIT	LEARNING OUTCOMES	THEORY	PRACTICAL
ENTREPRENEURIAL SKILLS – I	1. Identify various types of business activities	1. Types of businesses– service, manufacturing, hybrid 2. Types of businesses found in our community (Business activities around us)	1. Prepare posters of business activities found in cities/villages, using pictures 2. Discuss the various types of activities, generally adopted by small businesses in a local community 3. Best out of waste 4. Costing of the product made out of waste 5. Selling of items made from waste materials 6. Prepare list of businesses that provides goods and services in exchange for money
	2. Demonstrate the knowledge of distinguishing characteristics of entrepreneurship	1. Meaning of entrepreneurship development 2. Distinguishing characteristics of entrepreneurship 3. Role and rewards of entrepreneurship	1. Prepare charts showing advantages of entrepreneurship over wages 2. Group discussions on role and features of entrepreneurship 3. Lectures/presentations by entrepreneurs on their experiences and success stories 4. Identify core skills of successful entrepreneur
GREEN SKILLS – I	1. Demonstrate the knowledge of the factors influencing natural resource conservation	1. Introduction to environment 2. Relationship between society and environment, ecosystem and factors causing imbalance 3. Natural resource conservation 4. Environment protection and conservation	1. Group discussion on hazards of deteriorating environment 2. Prepare posters showing environment conservation 3. Discussion on various factors that influence our environment
	2. Describe the importance of green economy and green skills.	1. Definition of green economy 2. Importance of green economy	1. Discussion on the benefits of green skills and importance of green economy 2. Prepare a poster showing the importance of green economy with the help of newspaper/ magazine cuttings

SUBJECT SPECIFIC SKILLS

UNIT	SUB-UNIT	LEARNING OUTCOMES	SESSION / ACTIVITY / PRACTICAL
	AI REFLECTION	To identify and appreciate Artificial Intelligence and describe its applications in daily life.	Session: Introduction to AI and setting up the context of the curriculum • Recommended Activity: Make a statement about lighting and LUIS will interpret and adjust the house accordingly https://aidemos.microsoft.com/luis/demo
		To recognize, engage and relate with the three realms of AI: Computer Vision, Data Statistics and Natural Language Processing.	Recommended Activity: The AI Game • Learners to participate in three games based on different AI domains. – Game 1: Rock, Paper and Scissors (based on data) – https://next.rockpaperscissors.ai/ – Game 2: Semantris (based on Natural Language Processing - NLP) – https://research.google.com/semantris/ – Game 3: Quick Draw (based on Computer Vision - CV) – https://quickdraw.withgoogle.com/
	AI PROJECT CYCLE	Identify the AI Project Cycle framework	Session: Introduction to AI Project Cycle • Problem Scoping • Data Acquisition • Data Exploration • Modelling • Evaluation • Deployment

AI REFLECTION, PROJECT CYCLE AND ETHICS		Learn problem scoping and ways to set goals for an AI project.	Session: Problem Scoping Activity: Brainstorm around the theme provided and set a goal for the AI project. • Discuss various topics within the given theme and select one. • Fill in the 4Ws problem canvas and a problem statement to learn more about the problem identified in the community/ society • List down/ Draw a mind map of problems related to the selected topic and choose one problem to be the goal for the project.
		Identify stakeholders involved in the problem scoped. Brainstorm on the ethical issues involved around the problem selected.	• Activity: To set actions around the goal. • List down the stakeholders involved in the problem. • Search on the current actions taken to solve this problem. • Think around the ethics involved in the goal of your project.
		Understand the iterative nature of problem scoping for in the AI project cycle. Foresee the kind of data required and the kind of analysis to be done.	Activity: Data and Analysis • What are the data features needed? • How will the features collected affect the problem? • Where can you get the data? • How frequent do you have to collect the data? • What happens if you don't have enough data? • What kind of analysis needs to be done? • How will it be validated? • How does the analysis inform the action?
		Share what the students have discussed so far.	Presentation: Presenting the goal, actions and data. Teamwork Activity: • Brainstorming solutions for the problem statement.
		Identify data requirements and find reliable sources to obtain relevant data.	Session: Data Acquisition Activity: Introduction to data and its types. • Students work around the scenarios given to them and think of ways to acquire data. Activity: Data Features • Identifying the possible data features affecting the problem. Activity: System Maps • Creating system maps considering data features identified.
		To understand the purpose of Data Visualisation	Session: Data Exploration/ Data Visualisation • Need of visualising data • Ways to visualise data using various types of graphical tools. Quiz Time
		Use various types of graphs to visualise acquired data.	Recommended Activities: Let's use Graphical Tools • Selecting an appropriate graphical format and presenting the graph sketched. • Understanding graphs using https://datavizcatalogue.com/ • Listing of newly learnt data visualization techniques. • Top 10 Song Prediction: Identify the data features, collect the data and convert into graphical representation. • Collect and store data in a spreadsheet and create some graphical representations to understand the data effectively.
		Understand modelling (Rule-based & Learning-based)	Session: Modelling • Introduction to modelling and types of models (Rule-based & Learning-based)

		Understand various evaluation techniques.	Session: Evaluation Learners will understand about new terms • True Positive • False Positive • True Negative • False Negative
		Challenge students to think about how they can apply their knowledge of deployment in future AI projects and encourage them to continue exploring different deployment methods.	Session: Deployment Recommended Case Study: Preventable Blindness. Activity: Implementation of AI project cycle to develop an AI Model for Personalized Education.
		To understand and reflect on the ethical issues around AI.	Session: Ethics Video Session: Discussing about AI Ethics Recommended Activity: Ethics Awareness • Students play the role of major stakeholders, and they have to decide what is ethical and what is not for a given scenario. • Students to explore Moral Machine (https://www.moralmachine.net/) to understand more about the impact of ethical concerns
		To gain awareness around AI bias and AI access.	Session: AI Bias and AI Access • Discussing about the possible bias in data collection • Discussing about the implications of AI technology
		To let the students analyse the advantages and disadvantages of Artificial Intelligence.	Recommended Activity: Balloon Debate • Students divide in teams of 3 and 2 teams are given same theme. One team goes in affirmation to AI for their section while the other one goes against it. • They have to come up with their points as to why AI is beneficial/ harmful for the society
DATA LITERACY	**Basics of Data Literacy**	• Define data literacy and recognize its importance Understand how data literacy enables informed decision-making and critical thinking • Apply the Data Literacy Process Framework to analyze and interpret data effectively • Differentiate between Data Privacy and Security • Identify potential risks associated with data breaches and unauthorized access. • Learn measures to protect data privacy and enhance data security	Session: Basics of data literacy • Introduction to Data Literacy • Impact of Data Literacy • How to become Data Literate? • What are data security and privacy? How are they related to AI? • Best Practices for Cyber Security Recommended Activity: Impact of News Articles Reference Videos: • https://www.youtube.com/watch?v=yhO_t-c3yJY • https://www.youtube.com/watch?v=aO858HyFbKI • https://www.cbse.gov.in/cbsenew/documents/Cyber%20Safety.pdf
	Acquiring Data, Processing, and Interpreting Data	• Determine the best methods to acquire data. • Classify different types of data and enlist different methodologies to acquire it. • Define and describe data interpretation. • Enlist and explain the different methods of data interpretation. • Recognize the types of data interpretation. • Realize the importance of data interpretation	Session: Acquiring Data, Processing, and Interpreting Data • Types of data • Data Acquisition/Acquiring Data • Best Practices for Acquiring Data • Features of data and Data Preprocessing • Data Processing and Data Interpretation • Types of Data Interpretation • Importance of Data Interpretation Recommended Activities: • Trend analysis • Visualize and Interpret Data

	Project Interactive Data Dashboard & Presentation	• Recognize the importance of data visualization • Discover differWent methods of data visualization	Session: Project Interactive Data Dashboard & Presentation • Data visualization Using Tableau Reference Links • https://public.tableau.com/en-us/s/download • https://www.datawrapper.de/ Video Links: • https://www.youtube.com/watch?v=NLCzpPRCc7U • https://www.youtube.com/watch?v=_M8BnosAD78
MATH FOR AI (STATISTICS & PROBABILITY)	**Importance of Math for AI**	Analyzing the data in the form of numbers/ images and find the relation/pattern between the them. Use of Math in AI.	Session: Importance of Math for AI • Finding Patterns in Numbers and images. • Uses of Math - o Statistics o Linear Algebra o Probability o Calculus
		Number Patterns Picture Analogy	Activity: • observe the number pattern and find the missing number. • To find connections between sets of images and use that to solve problems,s
	Statistics	Understand the concept of Statistics in real life.	Session : • Definition of Statistics • Applications o Disaster Management o Sports o Diseases Prediction o Weather Forecast
		Application in various real life scenarios	Activity: Uses of Statistics in daily life • Students will explore the applications of statistics in real life .They collect data and can apply various statistical measures to analyze the data. Activity: Car Spotting and Tabulating Purpose: To implement the concept of data collection, analysis and interpretation. Activity Introduction: • In this activity, Students will be engaged in data collection and tabulation. • Data collection plays a key role in Artificial Intelligence as it forms the basis of statistics and interpretation by AI. • This activity will also require students to answer a set of questions based on the recorded data.
	Probability	Understand the concept of Probability in real life and explore various types of events.	Session: Introduction to Probability • How to calculate the probability of an event • Types of events • understand the concept of Probability using a relatable example. Exercise: Identify the type of event.
		Application in various real life scenarios	Session : Applications of Probability • Sports • Weather Forecast • Traffic Estimation Exercise: Revision time
INTRODUCTION TO GENERATIVE AI		Students will be able to define Generative AI & classify different kinds.	Recommended Activity: • Activity: Guess the Real Image vs. the AI-generated image
		• Students will be able to explain how Generative AI works and recognize how it learns.	Session: • Introduction to Generative AI • Generative AI vs Conventional AI:
			Session: • Types of Generative AI • Examples of Generative AI
			Session: • Benefits of using Generative AI • Limitations of using Generative AI
		• Applying Generative AI tools to create content. • Applying Generative AI tools to create content.	Recommended Activities: • Hands-on Activity: GAN Paint • Generative AI tools
			Session: • Ethical considerations of using Generative AI

INTRODUCTION TO PYTHON		Learn basic programming skills through gamified platforms.	Recommended Activity: • Introduction to programming using Online Gaming portals like Code Combat.
		Acquire introductory Python programming skills in a very user-friendly format.	Session: • Introduction to Python language • Introducing python programming and its applications
			Theory + Practical: Python Basics • Students go through lessons on Python Basics (Variables, Arithmetic Operators, Expressions, Comparison Operators, logical operators, Assignment Operators, Data Types - integer, float, strings, type conversion, using print() and input() functions) • Students will try some simple problem-solving exercises on Python Compiler.
			Practical: Flow of control and conditions 1. Students go through lessons on conditional and iterative statements (if, for and while) 2. Students will try some basic problem-solving exercises using conditional and iterative statements on Python Compiler.
			Practical: Python Lists 3. Students go through lessons on Python Lists (Simple operations using list) 4. Students will try some basic problem-solving exercises using lists on Python Compiler.

PART-C: PRACTICAL WORK

UNIT 5: INTRODUCTION TO PYTHON: Suggested Program List

PRINT

- To print personal information like Name, Father's Name, Class, School Name.
- To print the following patterns using multiple print commands-

- To find square of number 7
- To find the sum of two numbers 15 and 20.
- To convert length given in kilometers into meters.
- To print the table of 5 up to five terms.
- To calculate Simple Interest if the principle_amount = 2000 rate_of_interest = 4.5 time = 10

INPUT

- To calculate Area and Perimeter of a rectangle
- To calculate Area of a triangle with Base and Height
- To calculating average marks of 3 subjects
- To calculate discounted amount with discount %
- To calculate Surface Area and Volume of a Cuboid

LIST

- Create a list in Python of children selected for science quiz with following names- Arjun, Sonakshi, Vikram, Sandhya, Sonal, Isha, Kartik Perform the following tasks on the list in sequence-
  - Print the whole list
  - Delete the name "Vikram" from the list

- Add the name "Jay" at the end
- Remove the item which is at the second position.

- Create a list num=[23,12,5,9,65,44]
  - print the length of the list
  - print the elements from second to fourth position using positive indexing
  - print the elements from position third to fifth using negative indexing
- Create a list of first 10 even numbers, add 1 to each list item and print the final list.
- Create a list List_1=[10,20,30,40]. Add the elements [14,15,12] using extend function. Now sort the final list in ascending order and print it.

IF, FOR, WHILE

- Program to check if a person can vote
- To check the grade of a student
- Input a number and check if the number is positive, negative or zero and display an appropriate message
- To print first 10 natural numbers
- To print first 10 even numbers
- To print odd numbers from 1 to n
- To print sum of first 10 natural numbers
- Program to find the sum of all numbers stored in a list

Important Links

- https://cbseacademic.nic.in/web_material/Curriculum21/publication/secondary/Python_Content_Manual.pdf
- https://drive.google.com/drive/folders/1qRAckDculA5i164OUFDlilxb8mT65MMb

PART-D: Project Work/Field Visit/Student Portfolio

*relate it to Sustainable Development Goals

Suggested Projects/Field Visit/Portfolio (Any one has to be done)

Suggested Projects

1. Create an AI Model using tools like-
   - Teachable Machine (https://teachablemachine.withgoogle.com/)
   - Machine Learning For Kids (https://machinelearningforkids.co.uk/)
2. Choose an issue that pertains to the objectives of sustainable development and carry out the actions listed below.
   - To understand more about the problem identified, create a 4Ws problem canvas.
   - Identify the data features and create a system map to understand relationship between them
   - Visualize the data collected graphically (Spreadsheet software to be used store and visualize the data)
   - Suggest an AI enabled solution to it (Prototype/Research Work)

Suggested Field Visit

Visit to an industry or IT company or any other place that is creating or using AI applications and present the report for the same. Visit can be on physical or virtual mode.

Suggested Student Portfolio

Maintaining a record of all AI activities and projects (For Example Letter to Futureself, Smart Home Floor Plan, Future Job Advertisement, Research Work on AI for SDGs and AI in Different Sectors, 4Ws canvas, System Map). (Minimum 5 Activities)

Incorporates NEP 2020 & NCF 2023

The series has been designed with a new dimension of Joyful Learning and completely mapped with **National Education Policy**, 2020 & National Curriculum Framework, 2023, focusing on essential skills, and capacities.

Communication
Emphasis on soft skills and the power of language

Problem Solving & Logical Reasoning
Strengthens logical decision-making and innovation

Ethical & Moral Reasoning
Inclines towards empowering moral values in learners

Interdisciplinary
Connects knowledge across the curriculum for holistic development

Coding & Computational Thinking
Enables to help solve problems and makes thinking more engaging

Experiential Learning
Encourages 'learning by doing' through hands-on activities

Collaboration & Teamwork
Enhances interpersonal and intra-personal skills

Creativity & Innovativeness
Enhances imagination to generate new ideas

Digital Literacy
Aims at understanding and developing skills in a specific subject

Environmental Awareness
Focuses on understanding the importance of protecting the environment

Digital Resources

- Smart e-Book
- Answer Key
- Software Download Link
- Practice Worksheets
- Student Worksheet

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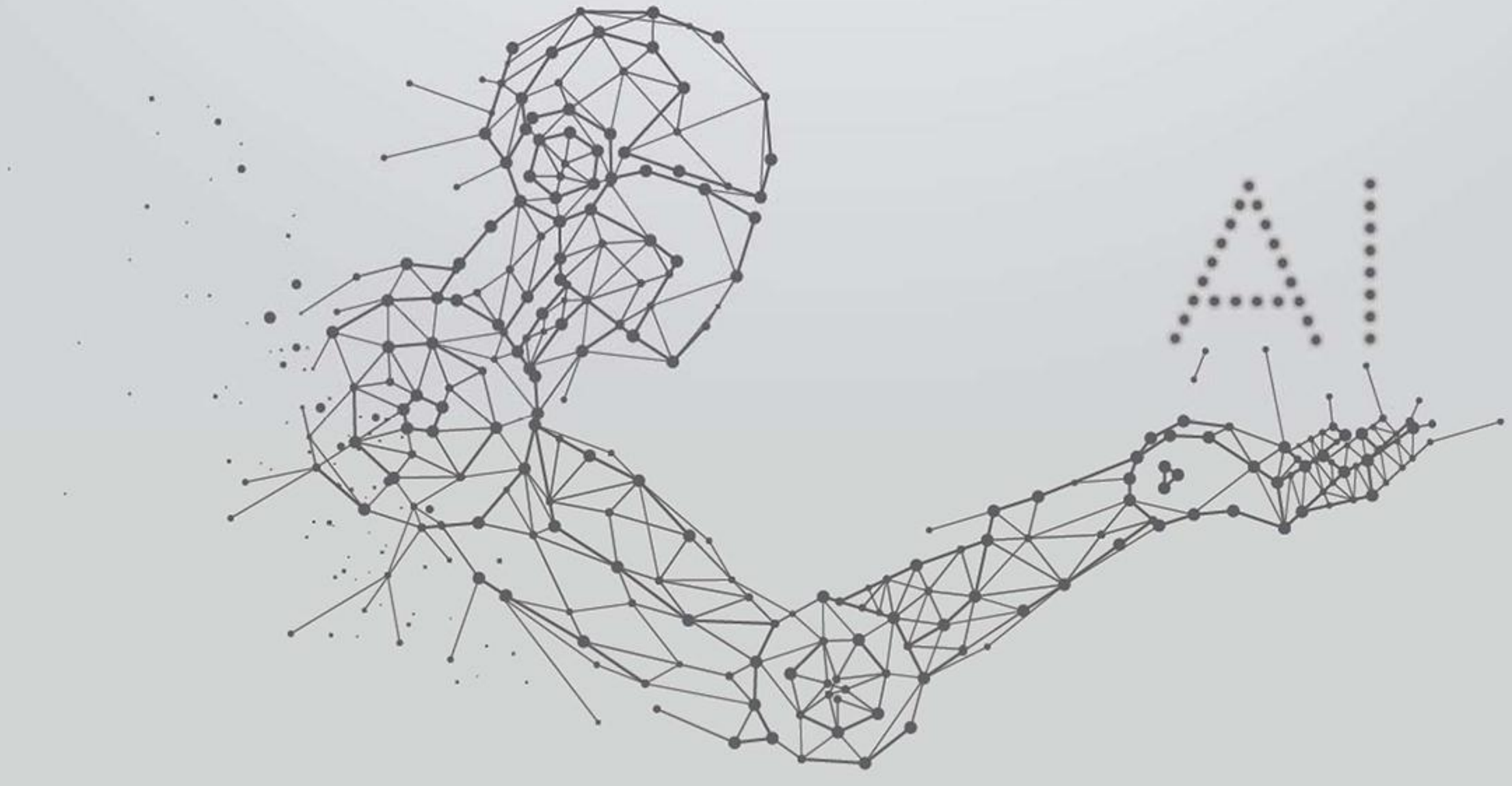
PART-A

EMPLOYABILITY SKILLS



UNIT-1

COMMUNICATION SKILLS-I

Learning Outcomes

- What is Communication?
- Effective ways of Communication
- Greetings
- 3P's of Public Speaking
- Phrases
- Parts of Speech
- When no Articles are used
- Pronunciation Basics
- Asking Questions-II
- Perspectives in Communication
- Types of Communication
- Talking about Yourself
- Writing Skills
- What is a Sentence?
- Use of Articles
- Construction of a Paragraph
- Asking Questions-I

Communication is an age old method to convey any information effectively. In this unit, we will discuss different ways of communication, which is very useful for a student to learn. If a person has good communication skills, then, it becomes easy to convey a message in short and simple sentences. This develops confidence and helps a person survive in the vast ocean of Information Technology (IT).

What is Communication?

The word 'communication' is derived from the Latin word *communicare*, meaning "to share". It is defined as a way of conveying a meaningful message from one entity to another in the form of signs, symbols, behaviour, verbal, and non-verbal skills. It is important that whatever we want to communicate is conveyed effectively.

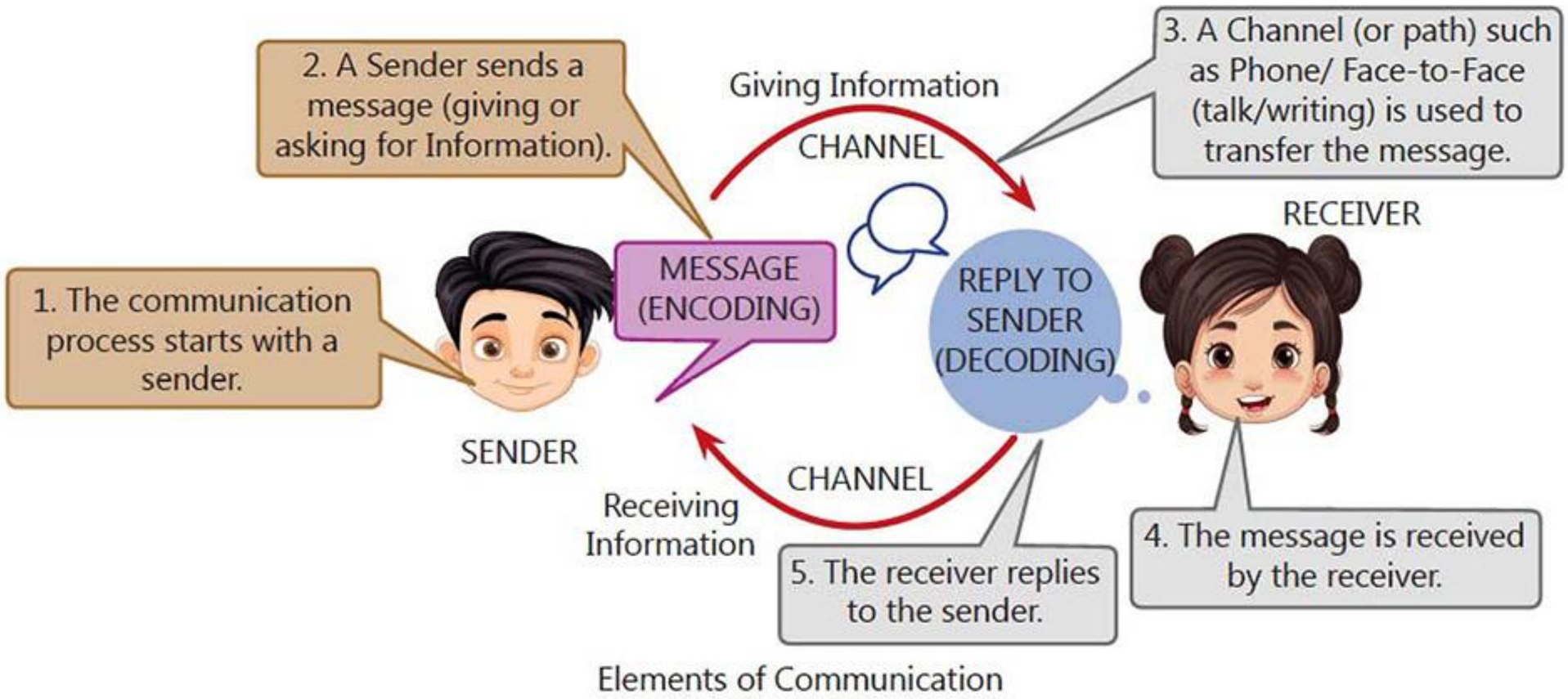
Importance of Communication Skills

Communication is a two way process. It is an interchange of ideas or information from sender to receiver and vice versa. Communication is important for many reasons mentioned below:

- **Inform:** Information is the most important reason for communication. Whenever there is a need to exchange ideas or information in a group or an organisation, it can be done through words, signals, signs, gestures etc. Information can also be gathered through personal interviews with prominent people. For example, a teacher teaching in a class passes the information to the students in that class.
- **Persuasion:** It influences a person to perform a specific task. For example, a mother persuades her child to work hard to score good grades in exams. A coach persuades his team to strongly face all the challenge in a match.
- **Express Feeling:** Talking about your felling is the healthy way to express them. For example, sharing your excitement about doing well in your exams or sharing your feelings with your parents and friends.

Elements of Communication

Communication is a two-way exchange of information, i.e., giving and receiving. Speaking and writing to someone are examples of giving information. Reading and listening to someone are examples of receiving information.



Elements of Communication

The basic elements of communication are:

- **Sender:** The sender sends a message either in the form of giving information or asking for information. The sender can be any person, group, or an organisation who initiates the process of communication. The sender's knowledge, experiences, and skills influence the quality of the message.
- **Ideas/Messages:** This message can be in the form of an idea or any information that a sender wishes to convey or asking for information from the receiver. The message is encoded i.e. created in the form of text, sign symbols which the receiver decodes or understands to find out its actual meaning.
- **Communication Channel**: It is the medium through which a message can be sent. It can be conveyed through oral, written or visual methods. These days, technology plays an important role in transmitting information through mediums such as email, voicemail, social media websites, etc.
- **Receiver:** A receiver can be any person, group, or an organisation who interprets the message conveyed by a sender. The receiver has to extract the meaning from the text, signs or symbols sent by the sender and find out its actual meaning.
- **Feedback:** It is the receiver's acknowledgement and response to the message for ensuring that they understood each other correctly.

Perspectives in Communication

Perspective is the fixed idea or thinking that influence how we communicate. Whether we are the sender or receiver of a message, our perspective can impact how we interpret that message, potentially altering its intended meaning. Let us assume that a teacher wanting to teach a difficult topic in a simplified way is not understood by the students, as the students assumed that the topic was too difficult to understand. This perspective of the students, that the topic is difficult, did not allow the students to understand despite the teacher's effort to make it simple.

Factors Affecting Perspectives in Communication

We face this problem of conveying and understanding the message due to some problems in our communication. Some of the factors that affect the perspectives in our communication are:

- **Language:** It is a very important factor that affects communication. Sometimes we are not familiar with the language in which we wish to communicate. Using wrong words at wrong places may alter the meaning of the message and thus do not solve the purpose of effective communication.

- **Visual Perception:** It is the ability of the brain to interpret the message received through our eyes. For example, solving the jigsaw puzzle based on the visual information processed by our brain.
- **Past Experience:** Our past experience influences our communication both as sender and receiver. For example, if a student scores bad grades in one test, he may lose his confidence and do not perform well in his next test.
- **Prejudice:** It is a preconceived idea, which can be favourable or unfavourable towards a person or a thing.
- **Feelings:** A sender or a receiver's feelings are very important for effective communication. If a sender is feeling low, then, the person will not be able to deliver the message appropriately. In case a receiver is feeling out of the place, he will not be able to perceive a meaningful message.
- **Environment:** If the surrounding area of the communication is imbalanced, then, the impact of the communication will not be much. Fear, anxiety, aggression, etc. strongly affect the communication skills.
- **Culture:** Different cultures interpret common signs, symbols and words with different meanings thus altering the overall meaning of effective communication.

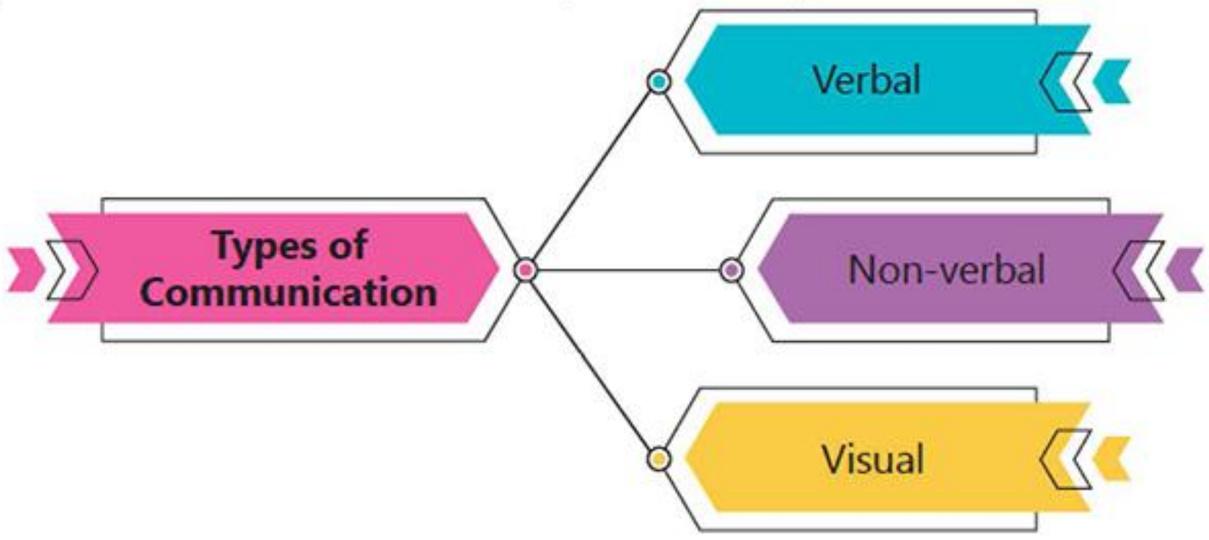
Effective ways of Communication

In order to ensure the communication is effective and engaging, we need to have a clear vision of 7 C's as discussed below:

- **Clear:** The content of the message you wish to communicate should be straight and clear so that it is easy to understand and interpret correctly.
- **Concise:** The message should be short and precise. Instead of using long sentences or paragraphs, we should focus on short sentences to convey our message.
- **Concrete:** The content should be clear in words with the direct focus on the message.
- **Correct:** The use of correct words, sentences, and grammar in whichever language you follow to communicate is very important.
- **Coherent:** The content of the message should stick to the topic and should flow in a sequence that makes sense.
- **Complete:** The message should be complete with all the required information for a necessary action.
- **Courteous:** The message should be ethically and politely conveyed, with no hidden insult or aggravated tone.

Types of Communication

There are mainly three types of communication: verbal, non-verbal, and visual. Let us discuss these in detail.



Verbal

Verbal Communication is using the words, sentences, and grammar of a specific language that can be spoken or written to share information with other people or an organisation. It is the most common method of communication. Proper body language, voice modulation, and polite tone enhance the impact of verbal communication.

Types of Verbal Communication

There are two kinds of verbal communication: Oral and Written.

Oral or Spoken Communication

Oral communication is communication using spoken words in an interactive way to share ideas or information. It can be a direct face-to-face conversation or a telephonic conversation.

Doing a presentation in a conference, conversing across a round table conference, or speaking to address the audience giving lectures by a teacher in a class are all examples of oral or spoken communication.

Following are the advantages of oral communication:

- Direct and interactive method of communication where the impact is spontaneous.
- It is time saving.
- Easy way to exchange ideas.

Following are the disadvantages of oral communication:

- It is less authentic as it is an informal way of communication.
- It is sometimes unproductive.
- If a common language is not a medium, then, using some words may have different meanings in different languages, which may alter the actual meaning of the message you wish to communicate.

Written Communication

Written communication is communication using written words to share ideas or information. Sending short messages through phones, writing letters, sending emails, making notes, or writing down speech to communicate, spreading information through books and magazines are a few examples of written communication.

Following are the advantages of written communication:

- It is an effective way of communication where the message can be stored for future references.
- It is impact-full and effective.
- It is easy to understand and interpret.

Following are the disadvantages of written communication:

- It is time consuming as feedback is not immediate.
- It costs more in terms of resources and manpower.
- It requires one to have a proper command over a written language.

Non-Verbal

Non-verbal communication is defined as communication through physical and physiological cues without using spoken or written words. The information is transmitted using body language, touch, facial expressions, symbols, signals, etc.

Most of our communication with the people around us throughout the day is non-verbal, and most of the time we are not aware of it. It is helpful when trying to understand others' thoughts and feelings.

When you are not interested in what the teacher is teaching in the class, you start looking around, disturb the person sitting next to you, fiddle with a pen or paper, and observe little things in the class. Without using words you are able to give the message to your teacher that lesson is very boring and you are not interested.

There are different types of non-verbal communication. Let us discuss about them.

Facial Expressions

Facial expressions are a very powerful way of conveying different forms of feelings and emotions. For effective non-verbal communication, you should smile when you meet someone, match your expressions with your words, and nod while listening. Being aware of your own facial expressions is very important in a professional environment. In one of the studies, it was found that the most trustworthy facial expression involved a slight rise of the eyebrows and a slight smile. Six basic facial expressions are—anger, fear, happy, disgust, sad, and surprise.

Body Language and Gestures

Body language means the position, gestures, and movement of the body to convey and interpret the attitude and feelings of a person. Positive body language can help you get what you want, if you know how to use it, whereas negative body language can make you miss out on opportunities or offend people you want to impress. One theory on the origin of human language is called "Gestural Theory", which conveys that, speech originated from gestures. Some of the common body languages and gestures are:

- Arms or legs across the chest.
- Rubbing or moving hands around.
- Standing with your hands clasped behind your back.
- Playing with your hair or nose.
- Putting your head in your hands.

Brainy Fact

The first modern book on body language appeared more than 350 years ago.

Eye Contact

Keeping a proper eye contact shows you are mentally present and actively involved in communication. The way you look at someone will reflect some of the strongest emotions and feelings during a social conversation. Rolling your eyes expresses displeasure or unhappiness with a situation. Eye contact helps you:

- Facilitate the connection with your audience in a meeting, conference, presentation, etc.
- Improve your concentration.
- Give confidence and authority.
- Retain the important points of conversation.
- Express your emotions like sadness, happiness, surprise, fear, etc.

Body Posture

Body posture is the position of the human body and its alignment and orientation with respect to non-verbal communication. During a conversation, the way you sit or stand and communicate your body postures to others depends a lot on your attitude and emotional state. Before you start a conversation, standing straight and holding your head high will have a great impact on the crowd.

The correct body postures for effective non-verbal communication are:

- Keep your shoulders straight and body relaxed.
- Sit straight while resting your hands and feet in a relaxed position.
- While standing, keep your hands by your sides.

Appearance

Appearance includes our choice of colour, body cleanliness, properly dressed, hairstyle, etc. When you are speaking in public, you may be representing your organisation or just yourself. You should ensure that you are properly and neatly dressed. It also increases your self-confidence and you will definitely feel good about yourself.

Personal Space and Proximity

Personal space refers to the appropriate distance during a conversation or space surrounding each person. Factors like regional culture, gender, age, ethnicity, or topic of conversation affects a personal distance. For example, while going on a lift, if a stranger enters, we feel uncomfortable and try making no eye contact and acting busy. Similarly, if a classmate sits on your seat, you will try your best to convince him to go to some other place as we have a claim to our own space and have a sense of control over it.

Paralanguage

Paralanguage includes aspects such as tone of voice, loudness, speed of speech, pausing, and even silence. This helps you understand the context and the meaning of the words used in the communication.

A cold tone of voice might suggest that you are actually not fine and don't wish to discuss it. A bright and happy tone of voice will reveal that you are happy with the things going around in your life. Silence or vocal pauses can communicate hesitation, the need to gather thought or serve as a sign of respect.

Haptics/Touch

Haptics is the power of touch in communication. Each touch conveys emotions and feelings in a physical form with a unique message like fear, disgust, love, encouragement, gratitude, sympathy, anger, pain, violence, etc. Studies have shown that it plays a very important role in the proper development of babies, and in animals, it works as a sign of love and care. You may begin your interaction with people by shaking hands and having casual conversation. This interaction can help establish trust before you start addressing your audience.

Advantages of Non-Verbal Communication

Some of the advantages of non-verbal communication are:

- It is used as complimentary with verbal communication to enhance the effect of communication.
- Information can be easily presented in non-verbal communication through gesture, body language, etc. For example, teacher with a finger on the lips conveys not to talk and sit quietly, to the whole class. A person addressing a crowd uses voice modulation to get the attention of the crowd. Sometimes nodding your head to say yes is enough to convey the message.

- Using gestures, facial expressions, eye contact, touch, etc. can be very helpful for individuals who are illiterate and physically challenged, especially with hearing and speaking problems.
- It is useful and easy method of communication where no common language is required to master.
- It is a fast method of communication as gestures have more impact than words.

Disadvantages of Non-Verbal Communication

Some of the disadvantages of non-verbal communication are:

- Since it uses gestures, facial expressions, eye contact, touch, signs, sound, etc. for communication, there are chances of misinterpretation of the message required to be delivered.
- Different cultures use different ways of non-verbal communication. The difference in message can lead to negativity and offense. For example, people who speak less and are less interactive are considered cold and arrogant. However, the Japanese admire silence and consider it as a key to success.
- It does not follow any rules or structures, therefore people unconsciously may engage in non-verbal movements which are considered offensive.
- It is not suitable for long and lengthy messages as the actual message may get lost in a lengthy and time-consuming conversation.
- Sometimes it is an incomplete form of communication and needs a support of verbal communication for effective and meaningful delivery of a message.
- Distant communication is not possible using non-verbal communication.

Visual Communication

Another important method of communication is visual communication, which involves sending and understanding messages only through images or pictures. The main advantage of this type of communication is that you do not need to know any particular language for understanding it. It is simple, easy to understand and remain the same across different places. Some common types of visual communication are:

Traffic symbol which communicate not to blow horn		Traffic Lights—Red for Stop, Yellow for Wait and Green for Go	
Sign for ladies and gents toilet		Sign showing railway crossing	
Sign for flammable substance		Sign for slippery surface	
Sign used to pause a video or audio file in smartphone or computer		Sign which communicates that the area is a no smoking zone	

Greetings

Greetings is the salutation used to welcome or greet a person. Greetings are an essential part of human communication and can vary greatly depending on who we are talking to and even according to the time of the day. The greeting and reply to a greeting at work is different from the greeting and reply given to a friend. Similarly, there are many ways to say goodbye when you depart.

Types of Greetings

Greetings serve to show people that you are happy to meet or see them and can be used in both formal and informal ways.

- Formal greetings are used with courtesy, and respect to communicate with someone meeting for the first time. It is generally a formal way to greet senior, elderly people. This is used in professional environments like in schools, colleges and offices. Formal greetings often involve a verbal acknowledgment and sometimes a handshake, with appropriate facial expression, gestures, body language, and eye contact.

  Some of the examples of the formal greetings are:

  * Greetings from the teacher: Good morning, everybody!
  * Reply by students: Good morning, Ma'am!
  * Greetings from the students: Good morning, Sir!
  * Reply by teacher: Good morning, everyone!
  * Greetings from an Employee: Hello Sir. How are you?
  * Reply by the Senior: Very well. Thank you! How are you?

- Informal greetings are casual and relaxed ways of acknowledging or welcoming someone, often used in social or personal settings. It is generally used for casual events, such as parties, social gatherings, or when meeting someone in a relaxed setting.

  Some of the examples of the informal greetings are:

  * Greetings from Friend 1: Hi!
  * Reply by Friend 2: Hey!
  * Greetings from Brother: Hey! How are you doing?
  * Reply by Sister: Hi! I am doing great!

- Greetings according to time refer to the different ways of greeting someone depending on the time of day. For example, "Good morning" is a common greeting used in the morning, while "Good afternoon" is used in the afternoon, and "Good evening" is used in the evening. These greetings are a polite and respectful way of acknowledging someone and are often used in both formal and informal settings.
- You should "introduce" yourself to people you are meeting for the first time or to those who are interested in learning more about you. This can be accomplished by simply stating your name and some general details such as your hometown, employment, courses taken in school, hobbies, etc. Always remember to smile and look the other person in the eye when introducing oneself.

- A person can be introduced to others by telling them their name, what they do, how we got to know them, or simply just sharing some interesting information about them.

Talking about Yourself

Talking about yourself is a fundamental part of communication, whether you're introducing yourself to new people, participating in an interview, or simply making conversation. Being able to effectively and confidently talk about yourself can help you make a positive impression and build meaningful connections.

You usually start by telling your name. Then you can talk about other things, such as what you do, your age, where you live, or even about the things or activities that you like or dislike. For all these sentences, you will use **nouns** and **verbs**.

A **noun** is a 'naming' word that is used for a person, place, thing, or idea. Some examples of nouns are Amaira, Delhi, Cricket and painting.

A **verb** is a 'doing' word that tells us what the noun does. Some examples of verbs are play, like, eat, and write. Note that some verbs with an 'ing' ending can also act as nouns. Swimming is an example. We can talk about likes and dislikes using nouns as well as verbs that end with 'ing'. For example, cycling and swimming.

Structuring Your Self-Introduction

To make sure your introduction is clear and interesting, follow these easy steps:

1. **Start with a Greeting:** Begin by saying hello in a polite way that fits the situation.
   Example: "Hi everyone!" or "Good morning!" or "Hi "
2. **Introduce Yourself:** Say your name and a little bit about who you are.
   Example: "My name is Akshaj, and I'm from Delhi."
3. **Expand on Key Points:** Talk a bit more about important parts of your life, like your job, what you study, your hobbies, skills, and what you hope to do in the future.
   Example: "I work as a Software Expert at Tech Point.
   In my free time, I love hiking and cooking.
   I'm good at organising events and helping others.
   In the future, I hope to become an Entrepreneur with my own Tech Company."
4. **Share a Personal Touch:** Add something unique about you, like an interesting experience or something you care about.
   Example: "One of my favorite experiences was volunteering in a training camp for physically challenged children in Mumbai. I believe in the importance of giving back to the community."

5. **Conclude:** Finish with a positive note, showing you're happy to be there or excited about the opportunity.

   Example: "I'm really excited to be here today and look forward to getting to know all of you."

Another example of introducing yourself when going for a job interview:

"Hello, my name is Riya Singh. I'm from Bengaluru and work as a digital marketing specialist with over six years of experience. I graduated from Delhi University with a degree in communications. In my current role, I specialise in social media strategy and content creation. Outside of work, I enjoy painting and volunteering at animal shelters. My goal is to lead a marketing team at a leading tech company."

Filling a Form

A form is a typed or printed page with blank spaces for information. Filling out a form means giving the information needed in the right places at the time of, applying for a job, filling a registration form or taking a survey. Each form is different, so you should read it properly before filling. Write neatly, taking care to use the correct spellings. It's important to take your time and double-check everything to avoid any errors.

A form usually has the following common fields where filling of the personal information is required.

- **Name:** It can be full name or in the form of first name, middle name, last name. It is always advisable to fill this in uppercase to avoid writing in a running hand and reduce the chances of making mistakes.
- **Date of birth:** It represents your date of birth in the given format - DD/MM/YYYY.
- **Address:** This is the postal address which includes your house number and the details of the street, area, and the city.
- **PIN code:** This is a group of numbers used by the post office to identify a region. It is an important part of an address.
- **Contact Information:** This includes your phone number and email address.
- **Signature and Date:** Most forms require a signature to confirm, the information provided is true and correct. Sign and date the form in the designated areas. Signature is your name or initials written by hand, in a specific way (which is difficult for anyone else to copy).

3P's of Public Speaking

Public speaking is speaking formally in front of a live audience. This can be giving a speech on a stage in front of a huge audience or giving a lecture in a class. It is a skill that you master only when you have command over a language with a pleasing personality and the ability to engage your audience with proper voice modulation. Most of the people have anxiety and feel nervous before going on stage. Let us study the power of 3P's which will help us to overcome our fears and make us an effective speaker.

Prepare

Prepare the content of your speech. Think about what your audience is expecting you to speak and then plan your content. Make it interesting in such a way that your audience feel engaged and are full of praises for you.

Practice

Rehearse out loud your speech before your D-day. Work to control your voice modulation, make a list of few filler words and plan your body movements and hand gestures. Practice, pause, and breathe. Use a clock to check your timings and allow time for the unexpected.

Perform

If you have done the preparation and practiced well, then, half of your battle is won. Just be confident of yourself and do not feel nervous.

Writing Skills

Writing skill is an important part of communication. It is an ability to express your ideas or thoughts. A good writing skill uses perfect words to express the accurate meaning of the message with more clarity. For this, a good command over a language plays a very important role. Let us study about various aspects which are important for having writing skills.

Capitalisation

Capitalisation means writing the first alphabet of a word in uppercase. In English grammar, we cannot decide on our own to write anything in capital. We follow the rules of capitalisation whenever we write anything. It gives emphasis on certain words used at different places.

Some of the basic rules of capitalisation which we all should remember in our basic writing skills are listed below:

- **Beginning of a sentence:** It is marked by capitalising the first letter in a sentence. For example:
  - My computer class is very interesting.
  - We are going for a movie today.
- **Proper Nouns:** Capitalise the first letter of a proper noun like name of a person, place or an organisation. For example:
  - New Delhi is the capital of India.
  - My friend Rohit loves to play cricket.
- **Days of week, months, and holidays:** Always remember to capitalise the first letter of days of week like Sunday, Monday, etc., months like June, August, etc., and holidays/festivals like Republic Day, Diwali, etc., but not the seasons like winter, spring, summer, etc. Let us look at an example:
  - Every year Republic Day is celebrated in India on 26 January.
- **The Pronoun "I":** Pronoun "I" is a reference to yourself and should always be capitalised. For example:
  - Reema and I are going for a picnic.
  - I love to read books before I go to sleep.
- **Directions:** The directions like North, South, etc. are written in capital only when they are referred to as locations. For example:
  - I am heading towards South.
- **Titles that appear before names:** The titles like President, Principal, Mr., Captain, etc. that appear before names are written with the first letter in capital. For example:
  - Mr. Singh is a good man.
  - President Peter gave a wonderful speech.

Punctuation Marks

These are the symbols used to help the reader understand the proper meaning of a sentence and where to pause or stop. Let us learn about some of the punctuation marks in detail.

Full Stop or Period (.)

Full stop or period is used at the end of a sentence. We also use it to shorten a word to form an abbreviation. For example, Mr. for Mister, Col. for Colonel.

Brainy Fact

There are 14 punctuation marks in English Grammar.

Question Mark (?)

Question mark is used to mark the end of any question asked in a direct speech. For example:

- How are you?
- Why did you not call me again?

Exclamation Mark (!)

Exclamation mark is used in a sentence to strongly express a feeling of happiness, sorrow, love, surprise etc. For example:

- Wow! Such a pretty dress.
- Oh! You got hurt badly.

Comma (,)

Comma is used to mark a pause in a sentence.

Any list of items mentioned in a sentence are separated by a comma. For example:

- I want a dress, shoes, watch, and a box of chocolate for my birthday.

It is sometimes used to separate two adjectives in a sentence. For example:

- I have a brown, fluffy golden retriever.

A sentence with the location specified has a city separated by a comma from the state. For example:

- Mahatma Gandhi was born in Porbandar, Gujrat.

When somebody is addressed in a direct speech. For example:

- Hi Swati, how is your job going on?

Apostrophe (')

Apostrophe can be used to indicate the omission of some letters in a word. For example:

- I'm enjoying my friend's company.
- It's very hot outside.

It is used to show the possession of a thing. For example:

- Adrissa's eyes are blue in colour.

Phrases

Phrase is a group of words together, but not a sentence that forms a complete meaning. It lacks the subject and the object. For example:

- On the roof
- Sleeping now
- Cannot eat
- Trying hard

What is a Sentence?

A sentence is a group of words arranged together and has a complete meaning. For example:

- I am reading a book.
- She went to school.
- My mother cooks good food.

Rules for Writing a Sentence

Following are the rules for writing a sentence:

- It begins with a capital letter.
- It ends with a full stop, exclamation mark, or question mark depending on the type of a sentence.
- It must contain one subject and one verb with an independent clause.
- It should have a meaning.

Parts of a Sentence

The two most basic parts of a sentence are subject and a predicate. Let us study about them.

Subject

A subject refers to a person performing an action. It tells us, what the sentence is all about. For example:

- Simmi loves cakes.
- My dog runs very fast.

Predicate

Predicate contains a verb that makes a statement about the subject. For example:

- My teacher marked me absent.
- Shweta dances very well.

Types of Objects

The object in a sentence can be either direct or indirect.

- **Direct:** Direct objects are the ones directly 'acted on' by the action word (verb). It answers the question "what?" or "whom?" after the verb. For example:
  - She read **a book**.
    - **What** did she read? A book.
  - The teacher called **the student**.
    - **Whom** did the teacher call? The student.
- **Indirect:** An indirect object is the noun or pronoun that receives the benefit of the action, or to whom, or for whom the action is done. It answers questions, such as 'to whom' and 'for whom'. For example:
  - She gave **her friend** a gift.
    - **To whom** did she give a gift? Her friend.
  - The teacher sent **the student** an email.
    - **To whom** did the teacher send an email? The student.

Examples with Both Direct and Indirect Objects

- **He sent her a letter.**
  * Verb: sent
  * Direct object: a letter (What did he send? A letter)
  * Indirect object: her (To whom did he send a letter? Her)
- **She baked her brother a cake.**
  * Verb: baked
  * Direct object: a cake (What did she bake? A cake)
  * Indirect object: her brother (For whom did she bake a cake? Her brother)

Types of Sentences

There are four types of sentences as explained below:

- **Declarative/Assertive sentence:** A sentence which gives information and makes a bold statement. It may state a fact. Most of the sentences of English language are assertive sentences. For example:
  * Monalisa is a beautiful girl.
  * Kohli is an excellent batsman.
- **Imperative sentence:** A sentence that makes a request or gives an order, an advice, or a command. For example:
  * Don't eat junk food.
  * Do not eat medicine on an empty stomach.
- **Interrogative sentence:** A sentence that asks a direct question and ends with a question mark(?). For example:
  * Are you hungry?
  * Where do you live?
- **Exclamatory sentence:** A sentence that shows an excitement or a strong feeling. It ends with an exclamation mark (!). For example:
  * Wow! You dance so well.
  * Your grades are excellent. Congratulations!

Active and Passive Sentence

In English, sentences can be structured in either the active or passive voice. Understanding the difference between these two can help give you more confidence in writing in English. So let's do few sentences and understand the importance of active and passive sentences in English language:

Active Voice

Sentences where the subject takes an action are known to be in the active voice. This structure is straightforward and often more dynamic and clear.

Structure

- Subject + Verb + Object

Examples:

- **She** (subject) **wrote** (verb) **a letter** (object).
- **Neha** (subject) **played**(verb) **a piano** (object).
- **The cat** (subject) **chased** (verb) **the mouse** (object).

Passive Voice

Sentences in which the subject receives an action are known to be in the passive voice. This structure can be useful when the focus is on the action itself or the recipient of the action, rather than, who performed the action.

Structure

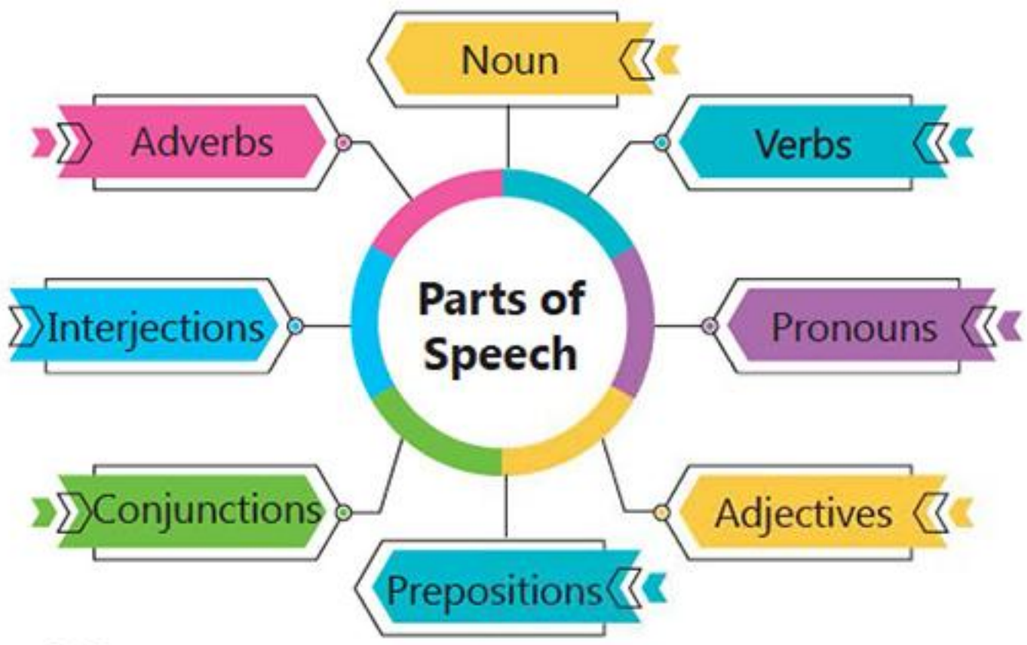
- Object of the active sentence becomes the subject + Form of "to be" + Past participle + by + Agent

Examples:

- **A letter** (subject) **was written** (verb) **by her** (agent).
- **The piano** (subject) **was played** (verb) **by Neha** (agent).
- **The mouse** (subject) **was chased** (verb) **by the cat** (agent).

Parts of Speech

A sentence is made up of words. Every word has a specific function to play in a sentence to make it meaningful. It falls into different categories to play a different role in a sentence. These categories are called the Parts of Speech. It is important to learn these different parts of speech to understand the language well, to help you construct good sentences for effective communication.



The basic parts of speech are as follows:

- **Noun:** Noun is a word that names a person, place, thing or an idea. For example:
  - Sunil is going to a school.
  - Goa is a beautiful place.
  - My pen is broken.
- **Pronoun:** Pronoun is a word that replaces a noun. They are used to avoid the repetition of nouns, so that, the sentences are smoother and effective. For example:
  - She likes to play in sand on the seashore.
  - It is our duty to keep our city clean.
- **Verbs:** Verbs are "doing words". It can be a word or a group of words that describes an action or a state of being. For example:
  - Shruti danced to celebrate my victory.
  - Gardener plucked the flower.
- **Adverbs:** Adverb is a word that describes a verb, an adjective or another adverb. It also tells how an action was done. For example:
  - John never participated in conversation.
  - Keep the book on the table placed there.

- **Adjective:** An adjective is a word that defines a noun or a pronoun. For example:
  * I have a beautiful dress.
  * My smart dog runs on a smooth road.
- **Conjunction:** Conjunction is a word that joins words, phrases, clauses, or sentences together. There are different types of conjunctions. Some conjunctions may be used to make a list while some may be used to connect thoughts, ideas or actions. For example:
  * I bought a pen, pencil, and ruler for my exams.
  * Neither this bridge nor that road is good to travel by car.
- **Preposition:** Preposition is a word that shows a relationship between a noun and a pronoun in a sentence. For example:
  * My cat is sitting under a dining table.
  * She jumped into the river.
- **Interjection:** An interjection is a word or a phrase that expresses a sudden or a strong feeling. Grammatically they are not related in a sentence but expresses a relationship between a word and a phrase in a sentence. Sometimes they are followed by an exclamation mark(!). For example:
  * Alas! I am so lost without you.
  * Great! You are coming with me.

Use of Articles

An article is a word that describes a noun. It is used before a noun to show whether it is specific or not. In English grammar there are three articles— A, An, The. They fall into the following two categories: definite and indefinite.

Definite— The

"THE" is a definite article which is used before a noun that indicates something clear or obvious. For example:

- The sun shines bright today.
- Give me the book on the table.
- The air quality is very bad in this place.

Indefinite— A, An

- 'A' and 'An' are indefinite articles which are used before a noun that are not specific or known before. "A" is used before a word beginning with a consonant (alphabets other than vowels) sound. For example:
  * A book (it can be any book)
  * A game (it can be any game)
- "An" is used before a word that begins with a vowel(a, e, i, o, u) sound. For example, an umbrella, an hour, an ice cream cone, etc.

When no Articles are used

- For common/general things. For example:
  * Fruits are good for health.
  * Do not eat medicines without doctor's prescription.
- Before a country, continent, island, mountain and lake' name. For example:
  * New Delhi is the capital of India.
  * Nagpur is famous for oranges.

- Before the name of any sport/game. For example:
  * I like swimming.
  * My friend plays tennis very well.

Construction of a Paragraph

A paragraph is made up of multiple sentences with a common theme. It begins with an introduction of a theme, followed by sentences describing the theme and ends with a statement supporting the common idea. For example, I love to travel. In the last two years, I have visited many places in India and abroad. I feel that travelling rejuvenates your mind and soul. It also gives us a clear picture of different cultures and people all across the world.

Rules for Writing a Paragraph

Following are the rules for writing a paragraph:

- It begins with a new line.
- The first line has an indentation.
- It focuses on a main theme.

Reboot

1. What is the sentence?

   _____

2. How many parts of a sentence are there?

   _____

3. Write the rules for writing a sentence.

   _____

4. What is the use of the comma in the sentence?

   _____

Pronunciation Basics

Pronunciation in English means how we say words, just as spelling is how you write a word. The first step in pronunciation practice is to understand that each language has its own unique set of sounds. Proper pronunciation is very important for clear communication. It helps people understand each other better. If we do not say (or pronounce) words correctly, others will not understand what we are saying. Correct pronunciation will help you express yourself in a clear and confident manner.

Here are the main parts of pronunciation.

- **Phonemes:** The individual sounds that make up words in a language. For example:
  * **/p/** as in "pat" and "cap"
  * **/t/** as in "tap" and "bat"
  * **/k/** as in "cat" and "kick"
- **Stress:** The emphasis we put on certain syllables or words. For example:
  * **"Desert" (noun):** DE-sert (a dry area of land)
  * **"Desert" (verb):** de-SERT (to abandon)

- **Intonation:** The rise and fall of our voice as we speak. For example:
  Used in yes-no questions: "Are you coming?" (The pitch rises at the end of the sentence)
- **Rhythm:** The pattern of stressed and unstressed syllables. For example:
  "The CAT is ON the MAT." (Stressed syllables: CAT, ON, MAT)

Phonetics

Phonetics is the study of the sounds that we make when we speak. We use sounds to speak. Every word is made up of one or more sounds. We put these sounds together to pronounce words. Phonetics is essential for understanding how languages use sound to convey meaning and for improving pronunciation in language learning. If you engage in phonetic exercises and training programs then it will help you enhance your pronunciation skills.

The English alphabet has 26 letters, from A to Z. But each of these letters can be pronounced in different ways in different words. We use 26 letters to write in English. But, we use more than 26 sounds when we speak English. This is why, a word's spelling does not always match its pronunciation. Let us see some examples.

Breakdown of Sounds

- **Cat (/kæt/):** The 'a' in "cat" is pronounced as a short vowel sound, /æ/, which is similar to "ऐ" in Hindi.
- **Father (/ˈfɑːðər/):** The 'a' in "father" is pronounced as a long vowel sound, /ɑː/, which can be approximated to "आ" in Hindi.
- **Name (/neɪm/):** The 'a' in "name" forms part of a diphthong, /eɪ/, which is a combination of two vowel sounds, similar to "ऐ" in Hindi.
- **About (/əˈbaʊt/):** The 'a' in "about" is pronounced as a schwa, /ə/, which is an unstressed and neutral sound, often represented as "अ" in Hindi.

Let us take the letter 'a' for example. Read the words below aloud. The letter 'a' is pronounced differently in different words as shown in the given table:

Words	Pronunciation of the letter 'a'	Pronuniation in Hindi
cat, apple and back	ऐ	कैट, ऐपल, बैक
car, fast and park	आ	कार, फास्ट, पार्क
call, ball and saw	ऑ	कॉल, बॉल, सॉव

Importance of Phonetics

By understanding and practicing phonetics, you can,

- **Improve Pronunciation:** It helps you learn the correct way to produce the sounds of English, leading to clearer and more accurate speech.
- **Enhance Listening Skills:** It gives you a better platform to recognise and differentiate sounds thus improving comprehension.
- **Reduce Accent:** It helps you gain awareness of how native speakers produce sounds, which helps in reducing accents.
- **Increase Confidence:** It guides you in speaking with correct pronunciation and thus boosts the confidence in communication.

Types of Sounds

In the English language the alphabets are not enough to match different types of sounds we make, when we speak. Let us take a closer look at the sounds we use. All English words are made of three basic types of sounds.

- **Vowels:** The English alphabet has five vowels (a, e, i, o and u) but there are 12 vowel sounds. This means, most vowels can be pronounced in different ways. We make a vowel sound when we read a vowel in a word. For example, we pronounce the letter 'i' in the word 'bit' by using a vowel sound. In Hindi, it is बिट
- **Diphthongs (combination sound of two vowels):** We make a diphthong sound when we combine two vowels. Diphthongs start as one vowel sound and go to another. For example, the sound 'ou' in the word "house" is a diphthong or a combination. In Hindi, it is हाऊस
- **Consonants:** A consonant sound is any sound that is neither a vowel nor a diphthong sound. For example, we use consonant sounds to say the letters 'p' and 't' in the word Pot. In Hindi, it is पॉट

Some more examples of different sounds are given in the table below:

Vowels Sounds			
long 'ee' (ी) sound	short 'i' (ि) sound	long 'u' (ु) sound	long 'oo' (ू) sound
Sleep स्लीप	Slip स्लिप	Book बुक	Boot बूट
Keep कीप	Dip डिप	Put पुट	Group ग्रूप
Feel फील	Fill फिल	Foot फुट	Two टू
Combination vowel (diphthong) sounds			
'ea' sound (ि+ ा)	'ae' sound (ॅ)	'oa' sound (ो)	'ou' sound (ा +ु)
Near नियर	Late लेट	Boat बोट	Mouth माउथ
Dear डियर	Cake केक	Loan लोन	Cow काउ
Hear हियर	Game गेम	Most मोस्ट	Cloud क्लाउड
Consonant sound			
'p प' sound	't i' sound	'k क' sound	'l ल' sound
Pen पेन	Train ट्रेन	Book बुक	Look लुक
Report रिपोर्ट	Story स्टोरी	Cold कोल्ड	Place प्लेस
Stop स्टोप	Put पुट	Music म्यूजिक	School स्कूल

Asking Questions-I

A question is a sentence, phrase, or word that either asks for information, or is used to test someone's knowledge. We always use a question mark (?) at the end of a question.

Do you sometimes feel afraid to ask questions? This is a common feeling, and it can stop you from getting the information you need.

What Happens If You Don't Ask Questions at the Right Time?

If you don't ask questions when you need to, several things can happen:

- **Confusion:** You might not understand things correctly.
- **Missed Information:** You could miss important details or opportunities.
- **Mistakes:** Without clarification, you might make errors.
- **Lack of Participation:** In class or meetings, not asking questions can make you feel less involved.

Need for Asking Questions

A question is a request for information. It could be any type of information, such as an answer to a question in the textbook, information about a person or a place or about how to do a task. Asking questions helps us to:

- gain new knowledge, get information.
- make sure that what we know is correct.
- avoid doubts, confusion, misunderstanding.
- start talking to people by asking about them and their ideas.

How to Make Sure We have Complete Information?

If you do not have information about how to reach a place, you will not be able to reach it. If you do not know how to do some work, you will not be able to complete it, unless you ask questions and get information. Asking all the correct questions at the right time is also important.

The method of '5W+1H' is a simple and effective way to ensure that you gather all the essential information necessary for completing a task or understanding a situation thoroughly.

For example, imagine you need to plan a class project. Using the '5W+1H' method, you would ask:

- **Who** will be part of the project team?
- **What** are the specific tasks and goals of the project?
- **When** is the deadline for completing different phases?
- **Where** will team meetings and project work take place?
- **Why** is this project important for the company or team?
- **How** will the team collaborate and execute the project tasks?

By systematically answering these questions, you ensure that all necessary information is considered, helping you plan effectively and achieve success in your work. Here's how it works:

- **Who:** This is about figuring out who is involved in the task or who is responsible for doing it. For example, if it's a school project, you'd want to know who your group members are.
- **What:** This helps you understand exactly what needs to be done or what the task is about. For example, for a project, this could mean knowing what topics you need to research.
- **When:** This tells you the timeframe or deadline for completing the task. It helps you plan when you need to finish each part. For example, if the project is due next week, you need to know when to start working on it.
- **Where:** This specifies the location or place where the task will happen. For example, a physical place like a classroom or an online platform for a virtual meeting.
- **Why:** Understanding the reasons or purpose behind the task helps you see its importance. For example, to learn something new, help others, or achieve a specific goal.
- **How:** This is about the methods or steps you'll use to complete the task. It helps you plan out what you need to do and how you'll do it. For example, if you need to write a report, you'd think about how to gather information and how to structure your writing.

Asking Questions-II

In our everyday conversations with others, we frequently need to ask questions and respond to them in order to gather information. Asking the right questions plays a crucial role in obtaining the right information we need. There are two basic types of questions: close-ended and open-ended.

Closed-Ended Questions

Closed-ended questions are those that can usually be answered with a simple "yes" or "no" or with a specific piece of information. They often have a straightforward answer and the answer options are limited or closed. For example:

- Are you coming to the party?
- Did you finish your homework?
- Have you been to Paris?

Framing Close-ended Questions

We can form close-ended questions by adding two types of auxiliary verbs (helping verbs):

- **Basic Auxiliary Verbs**

  Be, Do, Have: These verbs help convey different aspects of the action or state in a sentence.

- **Modal Auxiliary Verbs**

  Can, Shall, May, Should, Could: These verbs express possibility, necessity, permission, or ability.

Another way of framing close-ended questions is to take a sentence without the above words and place such words before the subject. For example:

Original Sentence	With Auxiliary Verbs
They talk on the phone every day.	**Do** they talk on the phone every day?
They have finished their homework.	**Have** they finished their homework?
You share your lunch with your friends.	**Could** you share your lunch with your friends?

Sometimes the helping verb changes based on the subject, but the main verb remains unchanged. For example, in the sentences and the questions below, the main verb (cook) remains unchanged, but the auxiliary verb (do) changes based on the subject. For example:

Original Sentence	With Auxiliary Verbs
They cook delicious food.	**Do** they cook delicious food?
He cooks dinner every evening.	**Does** he cook dinner every evening?

In some cases, **we exchange the positions of the subject and the verb** to create a close-ended question. We can follow a similar method for sentences that already have auxiliary verbs.

Original Sentence	Exchanging Subject and Verb
She is studying for her exams.	**Is** she studying for her exams?
They have completed the project.	**Have** they completed the project?

Open-Ended Questions

Open-ended questions are designed to encourage more detailed and expressive responses. They cannot be answered with just a "yes" or "no" and often require more thought and explanation. Examples:

- What do you think about the new project?
- How did you feel about the movie?
- Can you tell me about your favourite vacation?

Framing Open-ended Questions

Some questions are called open-ended because their answers are not limited or closed. They have to be answered with more information than just a "yes" or a "no". We can form open-ended questions by using question words, such as **What, Why, Who, How, When** and **Where**. For example:

Original Statement	With 5W1H
She traveled to India last summer.	**Where** did she travel last summer?
He visited his grandparents.	**Why** did he visit his grandparents?
She bought groceries.	**What** groceries did she buy?
They moved to a new city.	**When** did they decide to move to a new city?
He completed the project ahead of schedule.	**How** did he complete the project ahead of schedule?

At a Glance

- Communication is defined as a way of conveying a meaningful message from one entity to another in the form of signs, symbols, behaviour using verbal and non-verbal skills.
- Language is a very important factor that affects communication.
- Verbal Communication is using the words, sentences, and grammar of a specific language that can be spoken or written to share information with other people or an organisation.
- Non-verbal communication is a method of communication through body language, gestures using signs and hand movements, eye contact, facial expressions, etc.
- Visual communication is the visual representation of information in the form of graphs, flowcharts, signs, symbols, images, mind maps, road maps etc.
- Correct grammar and spellings is the key to good written communication.
- Phrase is a group of words together, but not a sentence that forms a complete meaning.
- A sentence is a group of words arranged together and has a complete meaning.
- A paragraph is made up of multiple sentences with a common theme.
- An article is a word that describes the noun.
- A paragraph begins with an introduction of a theme, followed by sentences describing the theme and ends with a statement supporting the common idea.

Exercise

Solved Questions

SECTION A (Objective Type Questions)

Quiz

A. Tick (✓) the correct option.

1. Who initiates the process of communication?
   a. Feedback ○ b. Sender ○
   c. Receiver ○ d. Communication Channel ○

2. Which of the following enhances the impact of verbal communication?
   a. Hand movements ◯ b. Touch ◯
   c. Voice modulation ◯ d. Hand shake ◯
3. Which of the following describes the orientation and positioning of our body to send various meanings?
   a. Body posture ◯ b. Sender ◯
   c. Communication ◯ d. Communication Channel ◯
4. Which of the following is the process of creating a message in the form of text, signs, symbols which the receiver has to decode to find its actual meaning?
   a. Feedback ◯ b. Communication ◯
   c. Decode ◯ d. Encoding ◯
5. Who interprets the message conveyed by a sender?
   a. Sender ◯ b. Receiver ◯
   c. Audience ◯ d. Organisers ◯
6. What is the purpose of communication? [NCERT]
   a. Inform (tell someone about something) ◯ b. Influence (get someone to do something you want) ◯
   c. Share thoughts, ideas, feelings ◯ d. All of these ◯
7. Which of the following is a group of words arranged together having a complete meaning?
   a. Language ◯ b. Sentence ◯
   c. Phrase ◯ d. Paragraph ◯
8. Which of the following is a word or a phrase that expresses a sudden or a strong feeling?
   a. Preposition ◯ b. Conjunction ◯
   c. Interjection ◯ d. Article ◯
9. Which of the following is a word that replaces a noun?
   a. Pronoun ◯ b. Verb ◯
   c. Phrase ◯ d. Preposition ◯
10. A ..... is made up of multiple sentences with a common theme.
   a. Phrase ◯ b. Sentence ◯
   c. Paragraph ◯ d. Speech ◯
11. How do you receive information on phone? [NCERT]
   a. Listening ◯ b. Speaking ◯
   c. Reading ◯ d. Writing ◯
12. Why do we send emails? [NCERT]
   a. To reach on time ◯ b. To share documents and files ◯
   c. To talk to each other ◯ d. To meet each other ◯

B. Fill in the blanks.

1. The ..... process helps in sharing of a common meaning between the sender and the receiver.
2. ..... is the ability of the brain to interpret the message received through our eyes.
3. ..... influences a person to perform a specific task.
4. ..... is the study of the sounds that we make when we speak.
5. ..... reflect a feeling of a person who is trying to communicate to give a proper meaning to a message.

C. Fill in the blanks with an appropriate article– A, An or The.

1. What is ..... price of this book?
2. I need ..... glass of water.
3. I went to see ..... Red Fort.
4. I want ..... apple.

D. Identify the kind of sentence.

1. What are you doing?
2. You are a nice boy.
3. Get out of the class.
4. Please switch off the fan.
5. Alas, I am ruined!

E. Convert the following Passive Voice into Active voice:

One example is done for you:

Passive: The flowers(subject) were watered (verb) by the gardener(agent).

Active: The gardener(subject) watered (verb) the flowers(object).

1. The cake was baked by my mother.
2. The concert was enjoyed by everyone.
3. The car was washed by the mechanic.
4. The homework was completed by the student.
5. The movie was directed by Steven Spielberg.
6. The park is maintained by the city council.
7. The song was performed by the band.
8. The painting was admired by the visitors.

SECTION B (Subjective Type Questions)

A. Short answer type questions:

1. Define the term Communication.

Ans. The word 'communication' is derived from the Latin word communicare, meaning "to share". It is defined as a way of conveying a meaningful message from one entity to another in the form of signs, symbols, behaviour using verbal and non-verbal skills.

2. Write any two advantages and two disadvantages of written communication.

Ans. Following are the two advantages of written communication:

- It is an effective way of communication where the message can be stored for future references.
- It is impact-full and effective.

Following are the disadvantages of written communication:

- It is time consuming as feedback is not immediate.
- Costs more in terms of resources and manpower.

3. Write two differences between oral and written communication.

Ans. Differences between oral and written communication are:

Oral Communication	Written Communication
It is communication using spoken words.	It is communication using written words.
It can be direct face-to-face conversation or telephonic conversation.	It is a process of sending short messages through phones, writing letters, sending emails, making notes or writing down speech to communicate.

4. Write the names of any three different types of non-verbal communication.

Ans. Facial expressions, Eye contact and Touch.

5. What is a Phrase? Give an example.

Ans. A phrase is a group of words together but not a sentence that forms a complete meaning. It lacks a subject and the object. For example, Good luck, Hot Lemon Tea.

6. What are punctuation marks?

Ans. Punctuation marks are the symbols used to help the reader understand the proper meaning of a sentence and where to pause or stop. There are 14 punctuation marks in English grammar.

7. What are articles?

Ans. An article is a word that describes the noun. It is used before a noun to show whether it is specific or not. In English grammar, there are three articles- A, An and The.

8. What is capitalisation?

Ans. Capitalisation means writing the first alphabet of a word in uppercase. In English grammar, we cannot on our own decide to write anything in capital. We follow the rules of capitalisation whenever we write anything.

9. What are closed-ended questions?

Ans. Closed-ended questions are those that can usually be answered with a simple "yes" or "no" or with a specific piece of information. They often have a straightforward answer and the answer options are limited or closed.

10. Rearrange the words to form questions. [NCERT]

a. she / like / sing / Does / to

b. waiting / What / are / you / for?

c. play / like / football / Do / you/to

d. Fighting? / they / are / Why

Ans. a. Does she like to sing?
b. What are you waiting for?
c. Do you like to play football?
d. Why are they fighting?

B. Long answer type questions:

1. What are basic elements of communication? Explain them.

Ans. The basic elements of communication are:

- **Sender:** The sender sends a message either in the form of giving information or asking for information. The sender can be any person, group or an organisation who initiates the process of communication. The sender's knowledge, experiences and skills influence the quality of the message.
- **Ideas/Messages:** This message can be in the form of an idea or any information a sender wishes to convey or asking for information from the receiver.
- **Communication Channel:** It is the medium through which a message can be sent. It can be through oral, written or visual methods. These days, technology plays an important role in serving as an important medium of transmission of information so we can send through email, voice mail, social websites, etc.

- **Receiver:** A receiver can be any person, group or an organisation who interprets the message conveyed by a sender. The receiver has to extract the meaning from the text, signs or symbols sent by the sender and find out its actual meaning.
- **Feedback:** It is the receiver's acknowledgement and response to the message for ensuring that they understood each other correctly.

2. Discuss the factors that affect perspectives in communication.

Ans. Some of the factors that affect the perspectives in our communication are:

- **Language:** It is a very important factor that affects communication. Sometimes we are not familiar with the language we wish to communicate. Using wrong words at wrong places may alter the meaning of the message and thus do not solve the purpose of effective communication.
- **Visual Perception:** It is the ability of the brain to interpret the message received through our eyes. For example, solving the jigsaw puzzle based on the visual information processed by our brain.
- **Past Experience:** Our past experience influences our communication both at the sender and at the receiver end. For example, if a student scores bad grades in one test, he may lose his confidence and do not perform well in his next test.
- **Prejudice:** It is a preconceived idea which can be favourable or unfavourable towards a person or a thing.
- **Feelings:** A sender or a receiver's feelings are very important for effective communication. If a sender is feeling low, then, the person will not be able to deliver the message appropriately. In case a receiver is feeling out of the place, he will not be able to perceive a meaningful message.
- **Environment:** If the surrounding area of the communication is imbalanced, then, the impact of the communication will not be much. Fear, anxiety, aggression, etc. strongly affects the communication skills.
- **Culture:** Different cultures interpret common signs, symbols and words with different meanings thus altering the overall meaning of effective communication.

3. Discuss effective ways of communication.

Ans. In order to ensure the communication is effective and engaging, we need to have a clear vision of 7 C's as discussed below:

- **Clear:** The content of the message you wish to communicate should be straight and clear so that it is easy to understand and interpret correctly.
- **Concise:** The message should be short and precise. Instead of using long sentences or paragraphs we should focus on short sentences to convey our message.
- **Concrete:** The content is clear in words with the direct focus on the message.
- **Correct:** Use of correct words, sentences, grammar of whichever language you follow to communicate.
- **Coherent:** The content of the message should stick to the topic and should flow in a sequence that makes sense.
- **Complete:** The message should be complete with all the required information for a necessary action.
- **Courteous:** Messages should be ethically and politely conveyed, with no hidden insult and aggravated tone.

4. What is a paragraph? Write the rules for writing a paragraph?

Ans. A paragraph is made up of multiple sentences with a common theme. It begins with an introduction of a theme, followed by sentences describing the theme and ends with a statement supporting the common idea. For example,
I love to travel. In the last two years, I have visited many places in India and abroad. I feel that travelling rejuvenates your mind and soul. It also gives us a clear picture of different cultures and people all across the world.
Following are the rules for writing a paragraph:

- It begins on a new line.
- The first line has an indentation.
- It focuses on the main theme.

5. Explain the different types of sentences.

Ans. There are four types of sentences as explained below:

a. **Declarative/assertive sentence:** A sentence which gives information and marks a bold statement. It may state a fact. Most of the sentences of English language are assertive sentences.
For example, God is great.

b. **Imperative sentence:** A sentence that makes a request or gives an order, an advice or a command.
For example, Don't use a pen to draw diagrams.

c. **Interrogative sentence:** A sentence that asks a direct question and ends with a question mark(?).

For example, Did you get your lunch packed?

d. **Exclamatory sentence:** A sentence that shows an excitement or a strong feeling. It ends with an exclamation mark (!).

For example, Wow! You are a graceful dancer.

C. Identify the type of communication in the following:

1. SMS from school for class picnic.
2. Class teacher announced the student of the month.
3. Singing a birthday song of your best friend.
4. Directions on the cover of your lego kit.

Unsolved Questions

SECTION A (Objective Type Questions)

Quiz

A. Tick (✓) the correct option.

1. When we communicate verbally, we should use ..... . [NCERT]
   a. difficult words ◯ b. simple words ◯
   c. confusing words ◯ d. abbreviations ◯
2. Which of these is not an appropriate non-verbal communication at work? [NCERT]
   a. Putting an arm around a coworker's shoulder ◯ b. Shaking hands firmly ◯
   c. Looking at the speaker with a smile ◯ d. Standing with an upright posture ◯
3. Sometimes ..... communication is difficult to understand.
   a. Non-Verbal ◯ b. Verbal ◯
   c. Visual ◯ d. None of these ◯
4. What is the process called when a receiver communicates his/her response back to the sender?
   a. Encoding ◯ b. Decoding ◯
   c. Feedback ◯ d. Communication Channel ◯
5. Which of the following is used for effective non-verbal communication?
   a. Avoid pointing at people with your finger. ◯ b. Shake hands confidently. ◯
   c. Maintain a proper distance. ◯ d. All of these ◯

B. State whether these statements are true or false:

1. Communication is a two way process. .....
2. Language is a very important factor that affects communication. .....
3. Decoding is the process in which the receiver and the sender are ensuring that they understood each other correctly. .....
4. If a sender is feeling low, then, the person will not be able to deliver the message appropriately. .....
5. The content should not be clear in words with the direct focus on the message. .....

C. Write an appropriate kind of sentences for the following

(Assertive, Imperative, Interrogation, Exclamatory):

1. How's the weather today?
2. It's a bright and sunny day.

3. Have you packed my lunch?
4. My favourite dessert is chocolate ice cream.
5. My hobby is baking.
6. Wow! This cake looks amazing.
7. Watch your steps in the staircase.
8. Get me a pair of scissors.
9. Please do the needful.
10. This is the latest edition of dictionary.

D. Identify noun, pronoun, verb, preposition and adverb in the following sentences:

1. She went to the market to buy fruits.
2. I am scared of thunder and lightning.
3. Ankit, what's your opinion about this?
4. Teacher Sunita teaches Physics and Mathematics.
5. Priya and her friends are going on a picnic.

E. Writing a paragraph.

1. Aparna has to write a paragraph on "IT as part of the education system". Help her to do the same.
2. Pratima has to present her thoughts on the topic "Gratitude", for her class assembly. Help her to write a paragraph for the same.

F. Fill in the blanks with an appropriate article— A, An or The.

1. Donate ..... organ, save life.
2. ..... human body produces a natural frequency.
3. Get me ..... pair of trousers.
4. It's ..... honour to be part of ..... guest speaker program.
5. ..... Earth is round.
6. Can I have ..... glass of water?

G. Convert the following Active Voice into Passive Voice:

One example is done for you:

Active: The chef (subject) cooks (verb) the meal (object).

Passive: The meal (subject) is cooked (verb) by the chef (agent).

1. She sings a beautiful song.
2. The teacher explains the lesson.
3. John reads a book every night.
4. They built a new house.
5. The dog chased the cat.
6. The chef cooks delicious meals.
7. The dog barked at the stranger.
8. I finished my homework.
9. He repaired the broken chair.
10. We planted a tree in the garden.

SECTION B (Subjective Type Questions)

A. Short answer type questions:

1. What is encoding in communication?
2. How environment affects perspectives in communication?

3. What is the meaning of coherent in communication?
4. What is oral communication?
5. Name the type of sentences that use question marks.
6. What are indefinite articles? Give examples.

B. Long answer type questions:

1. Write short note on Interjection and Conjunction.
2. Discuss any two types of non-verbal communication.
3. What are 3P's of public speaking? Discuss any two.
4. What are adjectives? Give an example.
5. What is Apostrophe(')? Where are they used?

C. Competency-based/Application-based questions:

#Communication

1. Sanchit has to write a paragraph on the topic 'Conservation of Water' for his assignment. He does not remember the assessment criteria for paragraphs. Help him outline the grading criteria of a paragraph.
2. Akash wrote a sentence, 'I bought an smartphone' in his English test, and the teacher marked it incorrect. Can you help him to write the correct sentence? Tell him the rules that he should follow while using articles in sentences.

Lab Activity

#Creativity

1. Suppose, you are a team leader in an organisation. You are asked to hire a candidate for your team. Create a Word document containing a list of qualities you want in the candidate. After creating the checklist, arrange an interview round in your class.
2. Write a paragraph about your plans for your birthday in MS Word document using simple sentences.
3. Write a story showing the conversation between a teacher and a student.

Class Activity

#Communication

1. Paper folding activity – To understand the importance of all components of communication. [NCERT]

   Step 1 Teacher distributes half a sheet of paper to all students.

   Step 2 Teacher instructs them not to ask any questions or look at others what they are doing. Teacher gives few instructions, like fold the paper (without telling which way), tear a corner (without telling which corner upper right/upper left/bottom right/bottom left) make a small hole (without telling where and how big)

   Step 3 After many incomplete instructions, teacher asks students to open the given papers.

   Step 4 Students shall be surprised to see that all papers look different.

   Conclusion- Students understand the importance of clear, precise and complete instructions for effective communication. They understand the importance of two-way communication, which allows the receiver to ask questions from sender for better clarity.

2. Let us play Dumb charades. To play this game, divide the class in two groups.

   Rules of the Game are:

   Team A will give a "Name of a Gadget" to Team B.

   One member from Team B will have to enact the "Gadget name" without speaking to his team and the team members have to guess its name.

   You can set up the rules for number of words, English/Hindi and so on. A member from Team B will have to enact these rules.

   Identifying the "Gadget Name" will give 10 points to Team B.

   While doing this activity, you will realise how without speaking a word and only with actions (Non-verbal communication) the message can be conveyed to others.

3. Fill in the given form for applying for a post of Student representative in your school.

Full Name	
Date of Birth	
Class - Section	
Residential Address	
Pin Code	
Phone Number	
Email address	
Your favourite sport (One Only)	

Answers

Exercise (Section A)

A. 1. b 2. c 3. a 4. d 5. b 6. d 7. b 8. c 9. a 10. c 11. a. 12. b

B. 1. communication 2. Visual Perception 3. Persuasion 4. Phonetics 5. Facial expressions

C. 1. the 2. a 3. the 4. an

D. 1. Interrogative sentence 2. Assertive/Declarative sentence 3. Imperative sentence
4. Imperative sentence 5. Exclamatory sentence

E. 1. My mother baked the cake.
2. Everyone enjoyed the concert.
3. The mechanic washed the car.
4. The student completed the homework.
5. Steven Spielberg directed the movie.
6. The city council maintains the park.
7. The band performed the song.
8. The visitors admired the painting.

Exercise (Section B)

C. 1. Written 2. Oral 3. Oral 4. Written

UNIT-2

SELF-MANAGEMENT SKILLS-I

Learning Outcomes

- Self-Management
- Who am I?
- Qualities of Self-Confident Person
- Self-Confidence Building Tips
- Personal Hygiene
- Self-Management Skills
- Self-Confidence
- Factors That Help in Building Self-Confidence
- Positive Thinking
- Grooming

We work hard every day to manage our personal and professional lives. Every day is like a small battle. Only when we plan our day, we can achieve our goals. Learning the skills of self-management is an essential task for students in the 21st century. Students with strong self-management skills arrive to class prepared, pay attention, follow directions, and work independently with focus. Let us study now how we can learn this skill to achieve our short term and long term goals.

Self-Management

In simple language, self-management means managing yourself. It's taking the responsibility of managing our own behaviour and actions. It is basically the ability to organise yourself with positive energy for the overall development in professional, personal, and social life. After every exam we often say this to ourselves that next time I will study hard and do well.

Positive Results of Self-Management

Self-management helps you to have a good control on your strength and weakness. Nothing can make you sad or unhappy unless you allow your emotions to flow in that direction. It is the process of preparing for the future. We have the following positive impacts on us with strong self-management skills.

Let us study a few of them:

- It helps in the overall development of a person.
- It polishes your skills and enhances your employability with better career prospects.
- It makes you realise your potential and maximises your productivity that helps you grow personally and professionally.
- It brings strong organisational skills that help you streamline your work.
- It helps you to have a good control on your good and bad emotions in such a way that your mind rules you, and not your emotions.
- It is always result oriented.
- It helps you stay focused on your goals.
- It makes you a responsible person as you are accountable to yourself for your efforts and hard work.
- It develops strong competitive spirit so that we are able to handle it in a healthy manner.
- It develops self-confidence as we trust our own abilities.

Self-Management Skills

Self-management skill is the ability to regulate your feelings and actions to achieve your goals independently and helps in the development of a strong personality. Some of the important self-management skills are discussed below:

- **Self-Awareness:** It is the awareness of your own personality. It is the ability to notice your feelings, your physical sensations, your reactions, your habits, your behaviours, and your thoughts. It enables you to learn about yourself in a way no one else can ever teach you. For example, as an individual, we are aware of artistic skills. If, I am good at fine arts, I will surely volunteer to participate in drawing competition.
- **Self-Confidence:** It is the trust in your own abilities, qualities and judgment. Some people are born with it and some learn to build up after facing the challenges of life. When you learn how to be confident, you can use it in your everyday life to tackle all of your goals. You can do any task that is given to you and not scared of taking risks. For example, it's a sense of self-confidence that takes a person on stage to speak in a public gathering.
- **Self-Motivation:** It is the force that drives you to do the things. Everything we do is motivated by some combination of conscious and unconscious needs or desires. Staying motivated is not something that happens naturally all the time. You should be ready to take challenges and open to positive learning. Remember that Impossible itself says 'I am Possible'. For example, it's only self-motivation that makes a good sportsperson.
- **Self-Control:** It is the ability to manage your impulse, emotions and behaviour. Know yourself so you can manage your emotions and impulses. It acts as a force to have a more successful and satisfying life. For example, Indian system of fasting is an excellent example of self-control. Fasting restricts a person from eating specific food.
- **Self-Commitment:** It is the state of being committed to yourself and being loyal to your actions. This is the first step to becoming conscious as you start looking at things in a more objective manner. Be who you are and stop fearing what others will think of you. For example, not eating junk food in any situation. Completing your school project on your own without any help.

- **Problem Solving:** It is an analytical skill that helps identifying a problem and finding a possible solution to it. It requires a person to be creative and intuitive. You should be confident in your approach as you learn which processes are most effective to overcome obstacles, which solutions may fail or could even create additional problems. For example, A teacher has to find on her own how she can improve the performance of her students.
- **Positive Thinking:** It is the optimistic approach to handle different situations in life. Rather than getting upset and blaming others for terrible situations, positive thinking will control the situation with logical reasoning. Remember that it's your response that truly determines the outcome. For example, A student securing bad marks will reason out with positive thinking that his efforts were not upto the mark.
- **Stress Management:** It is the technique to handle the levels of stress in day to day life by taking charge of your emotions, efforts, thoughts and surroundings. We all have stress— at home and at work. No single method works for everyone or in every situation, so experiment with different techniques and strategies. Focus on what makes you feel calm and in control. Don't let stress get in the way of your success. For example, Shifting to a new house with things scattered all over brings a lot of stress.
- **Time Management:** It is the method of planning and balancing your time to meet your everyday targets. It deals how effectively you utilise your time to achieve your goals. Staying organised can help you prioritise your activities based on their urgency and importance. Focus on your abilities to complete your work in an effective way. For example, Meeting the deadline of the project assigned in a class.
- **Organisational Skills:** It is the ability to plan and organise a given task in an effective manner. Good organisational abilities will prevent difficulty in your work and disorder in your daily life. For example, A student needs to have necessary material for the assigned activity, stay in their seat, and finish required work before going to the next assignment.

Who am I?

When you have a better understanding of yourself, you can develop good self-management skills making it easier to identify your strong and weak points. Think about things you enjoy doing, especially when asked to do it. You may enjoy sitting alone close to nature or making food for the family or lead a conversation in a group task or love to participate in a school cultural programme. This process of knowing yourself is the most challenging job. By putting time and effort you can take advantage of your strength and work on your weaknesses to overcome them. Let us see how we can handle this.

Knowing Yourself

Being aware of the purpose in life is very important to make your own existence feel. Knowing yourself helps you understand your own identity. It is important to know yourself in order to achieve success in life. It gives you purpose, direction and a true sense of well-being. In this process of knowing yourself, it is important to know our:

- Body and physical challenges
- Personality in private and public moments
- Morale and principles
- Strengths and weaknesses
- Temptations and frustrations
- Likes and dislikes
- Beliefs and opinions
- Background and relationships
- Positive and negative emotions
- Tolerance and understanding of others
- Creativity and interests
- Limits and boundaries

Knowing Your Strengths

Strength is the quality or the state of being physically and mentally strong. Assess your skills to identify your strengths. Your strengths will help you move forward on a path that's right for you. It helps you to identify what all things are good for you and which path to choose to outshine yourself.

You need to work on this and introspect yourselves so that you can use them, try them out and practice them.

By understanding ourselves we can
- know what we can and cannot do

→

Based on that information, we can
- plan what and how we can improve ourselves

→

By improving we will
- feel confident about ourselves

Examples of strengths are:

- Good in specific sports like cricket, basketball, swimming, football
- Focused in life
- Emotionally very strong
- Have strong self-control
- Not afraid of darkness
- Very innovative
- Disciplined
- Respectful
- Versatile
- Good interpersonal skills
- Healthy eating habits
- Good communication skills

We all have strengths but we are not aware of them sometimes. Anything that energises you and gives you inner contentment brings out the true side of your personality. Identifying your strengths is a very time consuming process and if you are not honest in your introspection, then, you may not succeed in this mission.

Steps to Identify Your Strengths

Following are the steps to identify your strengths:

- Identify your strengths by talking to a few people close to you. Listen to them honestly what they have to say good about you. Ask them:
  - What do you think I am good at?
  - What are my strengths?

    - How can I use my strengths to choose my career?
    - Which task can I do for hours without getting tired?
- List down the good things conveyed to you by these people, sit alone, and introspect.
- If you want to be doubly sure, then, you can also take a personality test by going to a professional.
- Feel your strength with these good points and what others have appreciated in you.
- Use your strength in choosing the correct path for your overall development.

Knowing Your Weaknesses

Weaknesses are the areas of improvement in your personal and social life. It is very important to know your weaknesses along with your strengths so that they don't end up hurting you.

If you are able to identify your traits that hold you back, then, it becomes easy to find a solution to overcome your weakness. You have to honestly start painting an accurate picture of yourself, so that you can actively use it to improve on your overall personality.

Examples of weaknesses are:

- Stage Fear
- Negative attitude
- Conservative personality
- Lazy and laid back attitude
- Insecurity
- Rigid
- Unhealthy habits
- Lacking presentation skills

Steps to Identify Your Weaknesses

Follow the given steps to identify your weak points:

- Identify your weaknesses by asking these questions from yourself:
    - What types of tasks do you leave incomplete?
    - What type of tasks make you feel bored and useless?
    - In what types of tasks do you seek help from others?
    - When did you feel unsatisfied and unhappy with your behaviour?
    - In what types of tasks others do better than you?
- Take the feedback from your friends, family, and colleagues to help you identify your weaknesses correctly.
- Take the criticism in a positive way.
- Use your strengths to improve on your weaknesses.
- Feel confident by overcoming your weaknesses.

Difference between Interests and Abilities

Interest is something you prefer to do and you enjoy doing it. It provides you a direction to develop your habits and skills. If you are interested in anything then motivation comes automatically. On your own, you will put extra time and efforts to complete an assigned task. Learning what you enjoy will help you develop your skills in it so that you can pursue it as a career in future. You may be good at playing guitar so give more time to it, enjoy exploring it and may pursue it as a career in future.

Ability comes naturally without any effort. It is your talent that you acquire naturally. It is a key for your happiness in life. It enable you to do a particular task efficiency with full confidence and good results.

Self-Confidence

Self-confidence in simple language means believing in yourself. It is respecting yourself by believing in your own abilities, strengths, and judgments. With your self-confidence you are more energised and motivated to take action and achieve your goals. You will devote your resources to try new things. If a speaker has confidence in his abilities he will communicate well on stage in front of his audience. Similarly if a student is prepared well, he will attempt his paper with full confidence.

Steps for Building Self-Confidence

Confidence helps you express the most beautiful version of yourself. A confident person is always focused in life and learns from his mistakes. If you compare yourself with others, you might struggle to concentrate and feel low in self-esteem. Instead of focusing on your work, you will be more worried about what others think of you. So let us now learn what steps we need to take to build our self-confidence:

Step 1: Appreciate achievements & accept failures	For example, celebrate the achievement when the team wins a competition. Articulate learning when the team loses a competition.
Step 2: Have a goal and take steps towards it	For example, if you have won bronze at an event, set the goal to win gold medal next time and take action for it.
Step 3: Always look at the good side and be happy	For example, if you have lost a match, celebrate the efforts of those team member who performed well. Talk to people who are confident and try to gain.

Qualities of Self-Confident Person

Confidence comes with knowledge and attitude. It is an age-long process of knowing yourself. If you are aware of your tasks, there will be very less chances of failure and this force is big enough to motivate you.

There are lots of other good qualities a self-confident person should possess to make his own identity in this world. Let us now study those qualities of a self-confident person:

- **Hardworking:** A hard working person is always more confident. He is aware of the fact that if nothing else, his hard work will be able to make him sail through the most difficult situation.
- **Positive attitude:** A positive attitude causes a chain reaction of positive thoughts, events, and outcomes. It is a catalyst and adds to the confidence of an individual.

- **Self-belief:** When we feel confident in ourselves, we are able to trust in our abilities, qualities, and judgment. When you believe in yourself, you're more confident to try new things.
- **Committed:** When you are committed to doing something, you accept no excuses, it's only results. Your confidence level will automatically increase with your commitment.
- **Focused:** It's only when you begin to focus, you transform, change and grow. If you stay focused, you will grow up to be a more confident person.
- **Knows your strengths and weaknesses:** Our strengths and weaknesses make our character. A confident person always focuses on his strengths and not on weaknesses.

Reboot

Fill in the blanks.

1. A hard working person is always more ..... .
2. A ..... attitude causes a chain reaction of positive thoughts, events and outcomes.
3. Confidence comes with ..... and attitude.

Factors that Decrease Self Confidence

It is important to identify the factors that contribute to low self-confidence and take steps to improve self-esteem and confidence:

- **Negative self-talk:** Constantly criticising oneself and having negative thoughts, can lead to low self-esteem and confidence. Especially, when we think we cannot do a particular work.
- **Past experiences:** When we keep thinking about our experience of pain, hurt, or trauma in the past. Instead of learning from them we feel bad about it.
- **Lack of Skills or Knowledge:** Feeling unprepared or lacking the necessary skills for a task or situation can decrease confidence.
- **Not putting enough effort:** When we expect to be successful at the first attempt itself and do not try again.
- **Criticism:** When we are surrounded by people who have a negative attitude and constant criticism in the form of verbal or behavioural criticism from them can harm self-esteem and confidence.
- **Stress and Anxiety:** Persistent stress or anxiety can undermine confidence and make it difficult to cope with challenges.

Factors That Help in Building Self-Confidence

People who lack confidence have excuses, whereas people with confidence have ambition to grow and rule the world. There are various factors that influence our self-confidence. Let's take a closer look at some of these factors.

Physical

Physical factors will influence the personality of a person. It includes your:

- Body language
- Physical appearance
- Good health
- Personal hygiene and grooming
- Non-verbal signs and gestures

- Mood swings
- Speaking style and accent

Good personal hygiene with a healthy physique boosts self confidence in a person. This will bring a positive mood and a great sense of happiness. People around you will treat you well. With this positive public image you will easily achieve your goals in life. For example:

- Wearing appropriate interview attire will help make the best first impression.
- A student with good oratory skills will always perform better in a class debate than a participant who is unexpressive.

Social

Social factors include our society and people around us. It can be the people in our classroom, family at home, friends in our colony, colleagues in our workplace, strangers on the street. Each one of us needs a push to start working harder, all of us want to be motivated by loved ones around us. The pressure of society has a very strong impact on the self-confidence of a person and will affect the performance of a person to a certain level. For example:

- Michael Jordan, the famous basketball player, was told in high school that he did not have the skill and felt dejected during his childhood.
- Dr. Seuss, the famous author of children's literature, was rejected by nearly 27 publishers early in his career.

Cultural

Cultural impact is the behavioural characteristics of people based on their surroundings, religions, traditions, customs, and festivals. We need to be sensitive to people belonging to different backgrounds. It shapes how we see ourselves and others in our society. Also a family's cultural values shape the development of a child. Young children may describe themselves based upon their family's values. For example, some cultures do not allow women to step out of the house and earn a living. She is expected to be dependent on a male member. Children are expected to be sober and quiet in front of elders. While in other cultures all are treated equally and have full right to live the life they want. The influence of culture shapes a person and has a great impact on self-confidence. For example:

- A female speaker in a saree may not feel confident in a conference where all are dressed up in western formals.
- A student belonging to a tribal community will not feel confident in a class presentation in his boarding school.

Reboot

Fill in the blanks.

1. ..... factors will influence the personality of a person.
2. ..... factors include our society and people around us.
3. Good personal hygiene with a healthy physique boosts ..... in a person.

Self-Confidence Building Tips

Self-confidence shapes your thoughts, feelings, and actions. When your self-confidence is low, you struggle in your relationships and at work, you don't feel happy, you don't cope well with stress and you probably lack energy and motivation.

So let's work on some tips that help a lot in building self-confidence:

- **Get Rid of Negative Thoughts:** Thinking about negative things is a dangerous habit. Try to get rid of the negative thoughts by trying to change the focus of your thoughts. Go out and play, dance, talk to your friends, take a nap, bake a cake— doing such kinds of activities will help you to drop negative thoughts.
- **Think Positively:** When there's positivity in your thoughts, automatically it will show in your actions. Count your blessings, start your day on a positive note. Reboot your mind and body. That's why every school day starts with a morning prayer. It helps to remove negative thoughts and adds positivity.

- **Stay Happy with Little Things:** Happiness always comes in small packages. Try to appreciate the smallest of things that you have and make the most of it. Show gratitude.
- **Stay Clean and Hygienic:** An individual's personal hygiene is very important. It is one of the biggest reasons of acceptance or rejection by your peer group. It not only builds confidence in you, but it also keeps you healthy.
- **Know Yourself:** Knowing yourself is the beginning of all wisdom. You are empowering yourself when you introspect. The better you know about yourself, the better is your relationship with the rest of the world.
- **Set a Goal for Yourself:** Dream enormously big and then work towards achieving your goals. True success is all about working towards meaningful goals and dreams. Goals need not be achieved always, but it leads you to move closer towards them.
- **Use your Experience:** Apart from academics, the only source of knowledge is experience.

  "Experience is the teacher of all things". **—Julius Caesar.**

Positive Thinking

Positive thinking has a great impact on our lives, our personality, our health and even on our career. It is an optimistic attitude that brings happiness and positive vibes all around by focussing on good in every situation. Accept the changes in life with a positive thought. Positive thoughts affect our health directly. Negative thoughts bring the emotions of fear, anger, and stress. Making a conscious effort to smile in stressful situations will keep your heart healthy.

While going for school, instead of stressing about a traffic jam, appreciate the fact that you can afford a car and get the comfort of travelling with your music on and spending time in your own decided space.

During this Covid time, instead of cribbing about not being able to socialise and going out with your friends for a birthday party, consider the opportunity to spend time with your family members who were earlier running out in their jobs and ignoring you. You have more time to discover your hidden talents.

Importance of Positive Thinking

Positive thinking can do wonders to us. It pushes you forward, encourages you, helps you overcome obstacles to bring happiness in your life. It always motivates you to believe in yourself to figure out all goodness in you. Now, let's explore how positive thoughts can further enhance our lives by opening up more possibilities:

- **Stress free environment**

  Start your day with a positive thought: "Today is going to be a good day". Create a positive environment by surrounding yourself with good souls. Find goodness in every word, in everything you see around you.
  - Go for a morning walk and appreciate all the little things you come across.
  - Do yoga and meditation to bring out positive energy in you.
  - Be polite to your friends, family, staff, and all other people around you.

- **Increases the efficiency**

  Positive thoughts will help you focus more in life to achieve your goals efficiently. It will enhance your skills and improve the quality of your work. For example, in class, when a teacher assigns you to form a group for your project, you'll be more willing to try new things because you feel more confident in gaining proficiency. With a positive mindset, you make a right team by seeing the best in each member and achieve your target of getting good grades for all.

  * Use your strength in a positive directions.
  * Learn from your mistakes to be on a right track.
  * Be polite to all by saying encouraging words:

    "Great", "You are amazing", "Excellent work".

- **Better health**

  Positive thinking brings a positive impact on your physical and mental health. Your immune system can sense the positive environment around you and will actively work in the rejuvenation of your mind and body. With a smile on your face, you will not feel stress and your brain will function in a better way.

  * Play outside with your friends in the evening.
  * Run and exercise to improve the blood circulation in your body.
  * Help your mother in the household work.

- **Improves relationships**

  With your positive thoughts when you start appreciating people around you, your relations with the whole world will improve. It will help you communicate well with the people close to you. Do not forget to appreciate your friends and family members to show your concern and will help you build long term relationships.

  * Give positive comments like
    - "Your writing skills are very impressive"
    - "You are good in group discussion"
    - "You have a flair for poetry writing"
  * Plan picnics together

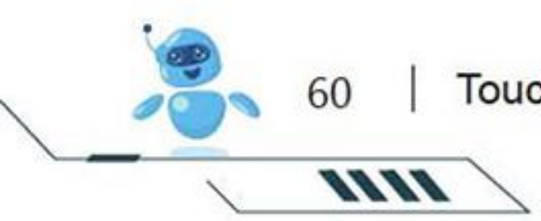
- **Boost self esteem**

  Positive thinking will strengthen your confidence and boost your self esteem. You will learn to face your fears and surround yourself with positive people. When you are thinking about yourself use positive words to describe your personality. This will automatically feel better and relaxed.

  * Take part in school activities like annual functions, class assembly, sports day.
  * Read inspirational stories in your free time.
  * Watch ted talk shows.

How to keep your thinking positive

- **Start your day with a positive gesture:** One small positive thought in the morning can change your whole day. Wake up every morning with the thought that something wonderful is about to happen. Every positive thought takes you in the right direction.
- **Manage time to relax:** A tired body can be harmful to your productivity and health. Relaxed mind brings inner strength, self-confidence, and positive thinking which are very important for your health.



- **Imagine the best in any situation:** No matter what challenging situation you find yourself in, imagine the best possible outcome and feel it. When you do, you can change the circumstances and situation into what you want. It makes you a positive person.
- **Learn to take feedback in a positive way:** Bill Gates said "We all need people who give us feedback. That's how we improve." Feedback is one of the essential elements of good communication. No matter how good you think you are, people around you will have all kinds of feedback, learn to take feedback in a positive way.
- **Express gratitude:** In our lives we do not realise that we receive a great deal more than we give. No one who achieves success does so without the help of others. Be thankful for what you have, you'll end up having more.

Smile

Start your day in a positive way	For example, exercising, reading, or watching something motivating; talking to people who are positive and make you smile.
Manage time to relax	For example, sit in a relaxed position and just feel how you are breathing. You can do yoga and meditation or listen to music to relax and stay calm.
Imagine the best in any situation	For example, do not keep thinking of things that are going badly, instead think how you can make things better.
Learn to take feedback in a positive way	For example, if someone gives you feedback, objectively think how it will help you to improve and start working on it.
Express gratitude	For example, be thankful for all the good things you have, to people who have helped you or pat your back for the good things you have done.

SMILE Model

Personal Hygiene

Personal hygiene refers to the practice of maintaining cleanliness. It involves various activities, such as bathing, washing hands, brushing teeth, and cleaning the body. Cleanliness helps us to maintain our health and well-being. Being healthy allows you to be regular at school, college or work.

Personal hygiene is important because, it helps us:

- in maintaining physical and mental health.
- prevents the spread of infections and diseases.
- contributes to a clean and pleasant appearance, promoting social acceptance and positive interactions with others.
- create a good image of ourselves.

Three steps to personal hygiene

Maintaining good personal hygiene involves a combination of daily habits and practices. Here are three essential steps to follow for effective personal hygiene:

CARE

- Keep your hair free of dandruff
- Rub oil/cream to take care of your skin
- Brush your teeth daily
- Change your toothbrush after a period of time.
- Cut your nails every week

WASH

- Wash your hands frequently
- Take bath every day
- Wash your clothes regularly
- Wash your hair at least every second day
- Wash your feet often

AVOID

- Blow your nose/cough into a handkerchief to avoid spreading germs
- Keep your feet dry and change your socks every day.

Essential Steps of Hand Washing

It is important to wash your hands frequently, especially before preparing or eating food, after using the toilet, after blowing your nose, coughing, or sneezing, and after touching objects or surfaces that may be frequently touched by other people, such as door handles, tables, gas pumps, shopping carts, or electronic cashier registers/screens.

The essential steps we should follow for our hand wash are:

Step 1 Wet your hands with clean, running water (warm or cold).

Step 2 Apply soap to your hands and lather by rubbing them together.

Step 3 Rub hands palm to palm.

Step 4 Right palm over left dorsum with interlaced fingers and vice versa.

Step 5 Palm to palm with fingers interlaced.

Step 6 Backs of fingers to opposing palms with fingers interlaced.

Step 7 Rotational rubbing of left thumb clasped in right palm and vice versa.

Step 8 Rotational rubbing, backwards and forwards with clasped fingers of the right hand, and vice versa.

Step 9 Rinse hands with water and dry with a single use towel.

Step 10 Use the towel to turn off the tap.

Grooming

Grooming is the practice of maintaining personal appearance, cleanliness, and overall well-being. It includes a variety of habits and routines that a person follows such as personal hygiene, skincare, hair care, and dressing. The way you dress, and groom can either send the message that you are confident, smart and sincere or possess opposite qualities.

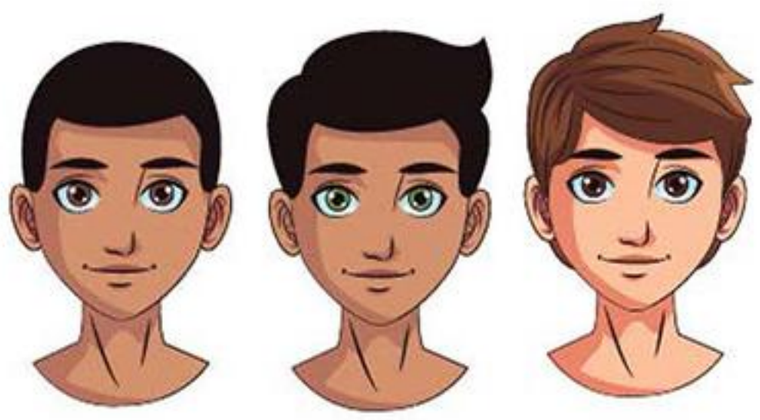
Dressing and grooming are important for a person to:

- look smart
- feel confident about ourselves
- make a good impression of ourselves

Guidelines for Dressing and Grooming

CLOTHES

- Clothes should be clean, neat, and ironed
- Shoes should be clean and polished
- Change socks everyday and always wear clean socks
- Keep accessories like belts, jewellery, etc., simple
- In certain jobs display of bodily tattoos and piercing is not accepted.



HAIR

- Hair should be washed regularly to keep clean.
- Simple hair styles and well combed hair gives a smart look.

FACE

- Face looks clean if you shave regularly.
- Moustache should be neatly trimmed
- Teeth should be kept clean, without any stains
- Brush the teeth twice a day to maintain dental hygiene
- Avoid eating Paan or chewing betel.

At a Glance

- Self-management is basically the ability to organise yourself with positive energy for the overall development in professional, personal and social life.
- Self-awareness is the awareness of your own personality.
- Self-confidence is the trust in your own abilities, qualities and judgment.

- Self-motivation is the force that drives you to do the things.
- Self-control is the ability to manage your impulse, emotions and behaviour.
- Self-commitment is the state of being committed to yourself and being loyal to your actions.
- Problem solving is an analytical skill that helps identifying a problem and finding a possible solution to it.
- Stress management is the technique to handle the levels of stress in day to day life by taking charge of your emotions, efforts, thoughts and surroundings.
- Time management is the method of planning and balancing your time to meet your everyday targets.
- Strength is the quality or the state of being physically and mentally strong.
- Weaknesses are the areas of improvement in your personal and social life.
- Physical factors will influence the personality of a person.
- Social factors can be the people in our classroom, family at home, friends in our colony, colleagues in our workplace, strangers on the street.
- Cultural impact is the behavioural characteristics of people based on their surroundings, religions, traditions, customs and festivals.

Exercise

Solved Questions

SECTION A (Objective Type Questions)

Quiz

A. Tick (✓) the correct option.

1. Which of the following helps you to have a good control on your strength and weakness?
   a. Motivation ◯ b. Self-management ◯
   c. Self-control ◯ d. Management ◯
2. Which of the following is the quality or the state of being physically and mentally strong?
   a. Strength ◯ b. Weakness ◯
   c. Ability ◯ d. Management ◯
3. Which of the following is not an example of strengths of a person?
   a. Leadership ◯ b. Artist ◯
   c. Stage fear ◯ d. Graceful dancer ◯
4. Which among the following is the state of being committed to yourself and being loyal to your actions?
   a. Self-Awareness ◯ b. Self-Motivation ◯
   c. Self-Commitment ◯ d. Self-Control ◯
5. Which of the following impacts is the behavioural characteristic of people based on their surroundings, religions, traditions, customs and festivals?
   a. Social ◯ b. Political ◯
   c. Cultural ◯ d. Natural ◯

6. Which of the following brings a positive impact on your physical and mental health?

a. Socialising ◯ b. Positive thinking ◯

c. Singing ◯ d. Over protection ◯

7. ..... include our society and people around us.

a. Social factors ◯ b. Financial factors ◯

c. Geographical factors ◯ d. None of these ◯

8. Which of the following is not a self-management skill? [NCERT]

a. Problem solving ◯ b. Bargaining ◯

c. Understanding self ◯ d. Confidence building ◯

9. Which of the following will influence the personality of a person?

a. Nature ◯ b. Physical factors ◯

c. Weather ◯ d. All of these ◯

10 Grooming is a term associated with ..... . [NCERT]

a. time management ◯ b. problem solving ◯

c. neat and clean appearance ◯ d. self-management ◯

11. Which of the following is not a quality of a confident person?

a. Focused ◯ b. Extravagant ◯

c. Positive attitude ◯ d. Committed ◯

12. Dressing and grooming are important because they help us to look ..... . [NCERT]

a. smart ◯ b. untidy ◯

c. shabby ◯ d. All of these ◯

B. Fill in the blanks.

1. ..... refers to the practice of maintaining cleanliness.
2. ..... is the force that drives you to do the things.
3. ..... is the method of planning and balancing your time to meet your everyday targets.
4. Apart from academics, the only source of knowledge is ..... .
5. Being aware of the ..... in life is very important to make your own existence feel.
6. ..... has a great impact on our lives, our personality, our health and even on our career.
7. ..... helps you understand your own identity.
8. A ..... causes a chain reaction of positive thoughts, events and outcomes.
9. A hard working person knows his hard work will be able to sail him through ..... .
10. ..... are the areas of improvement in your personal and social life.

C. State whether these statements are true or false.

1. Use your strengths to improve on your weaknesses. .....
2. This process of knowing yourself is the most easy job. .....
3. Self-management is not always result oriented. .....
4. Take the criticism in a negative way. .....
5. Social factors does not influence the personality of a person. .....

6. Negative thinking will strengthen your confidence and boost your self esteem. .....
7. We should find goodness in every word, in everything you see around you. .....
8. Positive thinking brings a positive impact on your physical and mental health. .....
9. It is not important to know yourself in order to achieve success in life. .....
10. Try to get rid of the negative thoughts by trying to change the focus of your thoughts. .....

SECTION B (Subjective Type Questions)

A. Short answer type questions:

1. What is self-management?

Ans. Self-management in simple language means managing yourself. It's taking the responsibility of managing our own behaviour and actions. It is basically the ability to organise yourself with positive energy for the overall development in professional, personal and social life.

2. What is an ability?

Ans. Ability refers to someone's 'Knowledge', 'skills' or 'talents' to achieve a result. It is the power to do things naturally with less effort. Not every ability is supported by an interest. If ability matches well with the areas of interests, then, it becomes the strength of a person. For example, An ability of a person to bake a cake like a professional.

3. What is self-motivation? Give an example.

Ans. Self-motivation is the force that drives you to do the things. Everything we do is motivated by some combination of conscious and unconscious needs or desires. Staying motivated is not something that happens naturally all the time. You should be ready to take challenges and open to positive learning.

For example: It's only self-motivation that makes a good sportsperson.

4. What is time management?

Ans. Time management is the method of planning and balancing your time to meet your everyday targets. It deals how effectively you utilise your time to achieve your goals. Staying organised can help you prioritise your activities based on their urgency and importance.

5. Define the term self-confidence.

Ans. Self-confidence in simple language means believing in yourself. It is respecting yourself by believing in your own abilities, strengths, and judgments.

6. Name any four importance of positive thinking.

Ans. Stress free environment, Increases the efficiency, Better health, Improves relationships.

7. What are the steps for building self-confidence?

Ans The steps for building self-confidence are:

Step 1: Appreciate achievements & accept failures

Step 2: Have a goal and take steps towards it

Step 3: Always look at the good side and be happy

8. Name any two ways that can be used to improve relationships.

Ans. Give positive comments, Plan picnics together.

B. Long answer type questions:

1. Give Steps to identify your weaknesses.

Ans. Following are the steps to identify your weaknesses:

- Identify your weaknesses by asking these questions from yourself:
  - Which task have you left incomplete?
  - Which task makes you feel bored and useless?

    - When do you ask for help to complete a specific job?
    - When did you felt unsatisfied and unhappy with your behaviour?
    - Which task others do better than you?
  - Take the feedback from your friends, family and colleagues to help you identify them correctly.
  - Take the criticism in a positive way.
  - Use your strengths to improve on your weaknesses.
  - Feel confident by overcoming your weaknesses.

2. Discuss any three self-management skills.

Ans. Following are three self-management skills:

- **Positive thinking:** It is the optimistic approach to handle different situations in life. Rather than getting upset and blaming others for terrible situations, positive thinking will control the situation with logical reasoning. Remember that it's your response that truly determines the outcome. For example, A student securing bad marks will reason out with positive thinking that his efforts were not upto the mark.
- **Stress Management:** It is the technique to handle the levels of stress in day to day life by taking charge of your emotions, efforts, thoughts and surroundings. We all have stress— at home and at work. No single method works for everyone or in every situation, so experiment with different techniques and strategies. Focus on what makes you feel calm and in control. Don't let stress get in the way of your success. For example, Shifting to a new house with things scattered all over brings a lot of stress.
- **Time Management:** It is the method of planning and balancing your time to meet your everyday targets. It deals how effectively you utilise your time to achieve your goals. Staying organised can help you prioritise your activities based on their urgency and importance. Focus on your abilities to complete your work in an effective way. For example, Meeting the deadline of the project assigned in a class.

3. What is strength? How it helps you? Give some examples of strength.

Ans. Strength is the quality or the state of being physically and mentally strong. Assess your skills to identify your strengths. Your strengths will help you move forward on a path that's right for you. It helps you to identify what all things are good for you and which path to choose to outshine yourself. You need to work on this and introspect yourselves so that you can use them, try them out and practice them. Examples of strengths are:

- Good in specific sports like cricket, basketball, swimming, football
- Focused in life
- Emotionally very strong
- Have strong self-control
- Not afraid of darkness
- Very innovative

4. Name the physical factors that will influence the personality of a person.

Ans. Physical factors will influence the personality of a person. It includes your:

- Body language
- Physical appearance
- Good health
- Personal hygiene and grooming
- Non-verbal signs and gestures
- Mood swings
- Speaking style and accent

5. What are the qualities of a self-confident person?

Ans. Let us now study those qualities of a self-confident person:

- **Hardworking:** A hard working person is always more confident. He is aware of the fact that if nothing else, his hard work will be able to make him sail through the most difficult situation.
- **Positive attitude:** A positive attitude causes a chain reaction of positive thoughts, events and outcomes. It is a catalyst and adds to the confidence of an individual.
- **Self-belief:** When we feel confident in ourselves, we are able to trust in our abilities, qualities and judgment. When you believe in yourself, you're more confident to try new things.

- **Committed:** When you are committed to doing something, you accept no excuses, it's only results. Your confidence level will automatically increase with your commitment.
- **Focused:** It's only when you begin to focus, you transform, change and grow. If you stay focused, you will grow up to be a more confident person.
- **Knows your strengths and weaknesses:** Our strengths and weaknesses make our character. A confident person always focuses on his strengths and not on weaknesses.

6. Discuss any two tips to build self-confidence.

Ans. Following are the two tips to build self-confidence:

- **Stay Happy with Little Things:** Happiness always comes in small packages. Try to appreciate the smallest of things that you have and make the most of it. Show gratitude.
- **Stay Clean and Hygienic:** An individual's personal hygiene is very important. It is one of the biggest reasons of acceptance or rejection by your peer group. It not only builds confidence in you, but it also keeps you healthy.

7. How can you keep your thinking positive?

Ans. We can keep our thinking positive by following way:

- **Start your day with a positive gesture:** One small positive thought in the morning can change your whole day. Wake up every morning with the thought that something wonderful is about to happen. Every positive thought takes you in the right direction
- **Manage time to relax:** A tired body can be harmful to your productivity and health. Relaxed mind brings inner strength, self confidence and positive thinking and that's very important for your health.
- **Imagine the best in any situation:** No matter what challenging situation you find yourself in, imagine the best outcome in it and feel it. When you do, you can change the circumstances and situation into what you want. It makes you a positive person.
- **Learn to take feedback in a positive way:** Bill Gates said "We all need people who give us feedback. That's how we improve." Feedback is one of the essential elements of good communication. No matter how good you think you are, people around you will have all kinds of feedback, learn to take feedback in a positive way.
- **Express gratitude:** In our lives we do not realise that we receive a great deal more than we give. No one who achieves success does so without the help of others. Be thankful for what you have, you'll end up having more.

8. What are the factors that affect self-confidence? [NCERT]

Ans. The factors that affect self-confidence are given the following:

- Social Factors: It is pre-evident that man is a social animal. We experience positivity and confidence when people appreciate our effort and respect us. It can be understood simply that when a man is in a comfortable, friendly environment, he forgets his weaknesses, flaws and incapabilities, rather he generates self confidence and starts using his qualities more rationally and takes more interest in social issues too. Hence, social factor plays an important role in confidence building as he takes positive inputs from the society around him and gives back the same.
- Cultural Factors: In this scientific era, where technology has excelled so much, we Indians still haven't forgotten our culture, family values and ethics. Our traditional culture holds important position in our lives. Keeping or sticking to cultural habits or traditional ethics, a strong value system or self recognition is felt in personality of a person and such feeling gives more of self confidence.

C. Competency-based/Application-based questions:

#Communication

1. You have noticed that your classmate does not wear appropriate clothes to school. You have to educate him about the dressing and grooming standards. What would you tell him?

Ans.
- Clothes should be clean, neat, and ironed
- Shoes should be clean and polished

- Change socks every day and always wear clean socks
- Hair should be washed regularly to keep clean
- Simple hair style and well-combed hair gives a smart look

2. Two of your classmates often get into fights and damage school tables. As you are the class representative, you need to talk to them to make them realise their mistake and learn how to improve upon them. What qualities and abilities do you need to do this? [NCERT]

Ans. Leadership qualities are as follow:

- Rational Thinking
- Self Confidence
- Motivating
- Good communication skills
- Problem Solving Skills
- Positive Thinking

Unsolved Questions

SECTION A (Objective Type Questions)

Quiz

A. Tick (✓) the correct option.

1. Which of the following is a factor that increases self confidence?
   a. When we think we can do a particular work. ○
   b. When we keep thinking of our past mistakes and feel bad about them. ○
   c. When we expect to be successful at the first attempt itself and do not try again. ○
   d. When we are surrounded by people who have a negative attitude, which is reflected in their speech. ○

2. Rahul gets feedback on his project work from his class teacher. Which of these options demonstrate a positive attitude in this situation? [NCERT]
   a. Rahul ignores the feedback. ○
   b. Rahul takes the feedback but does not use it. ○
   c. Rahul tells others that the teacher is wrong. ○
   d. Rahul learns from the feedback and makes his project work better. ○

3. What can you do to get rid of negative thoughts or feelings? [NCERT]
   a. Meditate to calm down and feel positive. ○
   b. Ignore them and move on in life. ○
   c. Act based on negative thoughts or feelings. ○
   d. Talk to a friend and share all your negative. ○

4. ..... inculcates confidence within an individual to face and handle different situations in life.
   a. Self hatred ○ b. Self care ○
   c. Freedom ○ d. Self management ○

5. It is the ability to manage your impulse, emotions and behavior. You should know yourself so you can manage your emotions and impulses.
   a. Self- Commitment ○ b. Self-Control ○
   c. Self- Motivation ○ d. Self-Confidence ○

B. Fill in the blanks.

1. ..... factors can be the people in our classroom, family at home, friends in our colony, colleagues in our workplace, strangers on the street.
2. ..... is an analytical skill that helps in identifying a problem and finding a possible solution to it.
3. When your ..... is low, you struggle in your relationships and at work, you don't feel happy, you don't cope well with stress and you probably lack energy and motivation.
4. Wearing appropriate ..... will help make the best first impression.

SECTION B (Subjective Type Questions)

A. Short answer type questions:

1. What is self-control? Give an example.
2. What are organisational skills?
3. Lack of self-confidence often lands a person in unwanted situations. Comment.
4. What is the role of experience in building up self-confidence?
5. Prepare a note of positive affirmations for yourself. Keep in mind your aim, you wish to achieve and the things which are obstructing your success.

B. Long answer type questions:

1. List any four positive results of self-management.
2. Write the steps to identify your strengths.
3. Why it is important to know yourself? Write some important points that help you in the process of knowing yourself?
4. How do social factors help in building self-confidence?
5. What is the difference between attitudes of people with low and high self-confidence?
6. List three things you will do for personal grooming in each of CARE, WASH and AVOID to keep clean. [NCERT]

C. Write the self-management skill that is represented by the following:

1. Your study table is cluttered. Your mother asked you to stack your books properly.
2. Your friend instigated you for a fight. You kept your calm.
3. Everyday morning you get up at 5:00 am for Yoga.
4. You are allowed to eat chips only on Fridays.
5. You volunteered for a role play in the class.

D. Competency-based/Application-based questions:

#Communication

1. Ankit is working in an organisation. He works in an unorganised way and never accomplishes his tasks/targets in time. You are his officemate. What one piece of advice would you give him to so that he learns about goal setting, scheduling, planning and self-discipline?
2. Do you judge yourself on the basis of other people's standards or expectations or your own views? Elaborate.

Lab Activity

#Experiential Learning

1. Create an Excel sheet and fill the strengths and weaknesses of yours. Highlight the weaknesses that you want to improve.
2. Prepare the following table in MS Word and tick in the blank cells accordingly:

Task	Yes	No	Sometime
Participate in class activities			
Ready to take challenges			
Grab the opportunities			
Ready to help others			
Discuss with teachers and classmates			
Ready to learn new Things			

3. Write the names of some topics on paper slips and ask the students to pick a slip. Student need to take 5 minutes and prepare a speech on the given topic. Ask each student to present the speech in front of the class.

Class Activity

#Creativity & Innovativeness

1. Activity- Interests and abilities. [NCERT]
   Materials required:
   Student textbooks, pen, worksheets
   Procedure:
   Each student has to complete two worksheets, each containing a list of statements. First worksheet is for interests and the second is for abilities. Each student has to be real and honest when marking the statements in the two worksheets if he/she is not real and honest, they will get incorrect results about their own interests and abilities.
2. Activity- Building confidence through positive words. [NCERT]
   Materials required:
   Pen/pencil, notepad or sheets of paper
   Procedure:
   Make a list of feel-good sentences that you will say to yourself every day when you wake up in the morning and before you go to bed. For example, you can think of:
   a. something that you are really proud of,
   b. a compliment you have received from someone that day or the previous day,
   c. a learning that you had after reflecting upon your failure.

Answers

Exercise (Section A)

A. 1. b 2. a 3. c 4. c 5. c 6. b 7. a 8. b 9. b 10. c 11. b 12. a

B. 1. Personal hygiene 2. Self-motivation 3. Time management 4. experience 5. purpose
6. positive thinking 7. Knowing yourself 8. positive attitude 9. difficult situation 10. Weakness

C. 1. True 2. False 3. False 4. False 5. False 6. False 7. True 8. True 9. False 10. True

UNIT-3

ICT SKILLS-I

Learning Outcomes

- ICT
- What is a Computer?
- Processing Device—Central Processing Unit (CPU)
- Computer Memory
- Peripheral Device Ports
- Understanding Operating System
- Procedure for Starting a Computer
- Common Desktop Operations
- Managing Files and Folders in Windows 11
- Keyboard Operations in Windows 11
- Using Keyboard
- Terminologies of the Internet
- Email
- Composing an Email
- Digital India
- Mobile Device Layout
- Input Devices
- Output Devices
- Measuring Unit for Memory
- Motherboard
- Booting
- Windows 11—An Operating System
- Files and Folders in Windows 11
- Mouse Operations in Windows 11
- Shutting down the Computer
- Internet - Introduction
- Microsoft Edge
- Creating an Email Account
- Introduction to Social Media

In the past few years, Information Technology (IT) has completely changed the ways we live. The Internet has become a convenient way to access the information. It has affected our both teaching and learning processes. Strong connectivity features has increased the usage of smartphones. The whole world has shrunk into this little device only through the use of Information and Communication Technology (ICT). Let us now study in detail the role of ICT in our life and how we can enhance our ICT skills.

ICT

Information Technology is the use of hardware, software and networking technology for accessing, storing, retrieving and transmitting the information.

Communication Technology is defined as exchange of information through networks using either wired or wireless media.

So, if we combine these two important technologies in this digital world, then, it forms a new term called Information and Communication Technology which can be defined as use of hardware, software, networking to transmit, store, access and retrieve the information in the form of text, graphics, audio, video, multimedia in a digital platform.

Role and Importance of ICT

ICT is used in our personal, professional and daily life. Let us study about it in detail.

ICT at Home

If we see around us, technology is involved in our daily chores. Change in address required, applying for passport, going for vacation—checking for weather conditions for packing, looking for best Indian platter for dinner— all these can be achieved through technology.

Impacts of ICT in our personal life are:

- **Education:** Conventionally education was limited to one to one teaching methodology of students and teachers in a classroom. Now with ICT, the classrooms have no geographical boundaries. You can enroll for a course from New York University, while sitting in your study room in New Delhi. Most universities have started online degree programs to reach a vast audience.
- **Healthcare:** ICT has played an important role in the field of healthcare. The Government creates awareness and prevention methods of upcoming and ongoing diseases. Hospitals use electronic mediums to maintain the medical records of their patients. Computer based machines are used for diagnosis purposes in the radiology department. So much so AI is commonly used where we see robots performing operations on patients.
- **Socialising:** There were times when we used to maintain birthday calendars for our friends and family. ICT brings this new way in the form of reminders which help you to send your greetings. You can get connected to your school/college friends through different websites which are primarily made for socialising.
- **Source of Information:** In older days, the only source of information was books or our elders. Nowadays, even after the consultation with the medical expert, we always tend to verify and gain more information on the medication as well as on the diagnosis. It's a source of information in every field.
- **Shopping:** Our shopping habits have changed because of the online medium. Instead of going to market, we can receive everything at our doorstep with online shopping. It not only saves our effort of going out but also provides us with options of reasonable prices.
- **Communication:** ICT helps us to communicate to our friends and relatives. There are more and more ways to talk to people without meeting them. For example through emails, video conferencing, video calls, etc.
- **Entertainment:** Till now television was the only way of home entertainment. The trend has changed tremendously. Nowadays there's a parallel entertainment industry that is producing entertainment programs for online mediums. There are series and movies that are launched online only.

ICT at Workplace

With the inclusion of technology in our daily lives, our workplace is no longer our office. With the use of technology, you will see there are many people who have started the concept of "Work from Home". ICT in our professions can be used in many ways:

- **Maintenance of Records:** There are software tools that are designed specifically to maintain employees' records. These tools have the capacity to maintain intra office records like employee's leaves, insurance, tax, etc.
- **E-Commerce:** With the prevalence of e-commerce, businesses have a new channel for sales and services. It has changed the way our society spends money. Buying and selling of products have become very convenient.
- **Handling of Accounts:** There are various tools available that facilitate the accounting jobs that are required for business and personal purposes. You don't need a professional to make a balance sheet or Profit and Loss accounts. An individual can do it on his own with help of accounting tools easily available.
- **E-Banking:** Banking transactions do not always need going to bank. Banks are now available in an online mode. So much so that new accounts can also be created in an online mode. Movement of money in an online mode is always a catalyst to the developing economy of a country.

ICT at various other sectors

You can visit the following sites and know about the ICT activities which are being carried out in various sectors:

Sector	ICT used for	Website
Agriculture	Various activities related to research, development and training in agriculture and allied fields	http://dare.nic.in/ http://bit.ly/2H3DJfU
Retail	Training programmes in the retail sector	http://rasci.in/
Beauty and Wellness	Training programmes in beauty and wellness sector	http://www.bwssc.in/
Banking and Finance	Training programmes in banking, financial services and insurance sector	http://bfsissc.com/
Apparel	Training programmes in Apparel sector	http://sscamh.com/indexHome.php
Logistics	Training programmes in Logistics sector	http://lsc-india.com/
Health Care	Training programmes in Health care sector	http://www.healthcare-ssc.in

ICT Tools

Smartphones and tablets are essential ICT tools that have become increasingly popular in various aspects of life, including education, communication, and entertainment. These devices have become indispensable for collaboration, and without them, many individuals find it challenging to engage in cooperative work. The widespread use of social media platforms on the internet has facilitated the rapid dissemination of ideas and news globally. Now, anyone with internet access can share their perspectives on various topics, ensuring that their thoughts or information reach a broader audience.

Smartphones

Smartphones are considered important ICT tools due to their multifunctionality and portability. It enables users to seamlessly integrate work, communication, and entertainment, which enhances accessibility and connectivity.

Smartphones are also called mobile phones as you can use them anywhere—at home, in the office or on the road. They do not need a telephone line. They use wireless (mobile) networks to make calls and to connect to the Internet. Some of the popular operating systems for smartphones are Android OS, Apple iOS and Windows Mobile.

Different things that can be done with Smartphones are:

- They are used to make and receive voice calls or video calls.
- You can access the internet, enabling users to browse websites, access information, and stay connected to online services.
- It serves as portable email device, allowing users to send, receive, and manage emails on the go.
- The phone camera provides video recording, enabling users to capture photos, record videos.
- It supports a variety of applications, such as mobile offices with document editing, note-taking, and task management tools.
- With built-in GPS technology, smartphones offer navigation services, helping users find directions, locate places of interest, and plan routes.
- It helps in accessing social media platforms, facilitating social interaction, content sharing, and staying connected with friends, family and others.
- It provides a platform for various forms of entertainment, including games, streaming services, and e-books.

- It supports mobile banking applications and secure transaction services, allowing users to manage finances, make payments, and conduct transactions from their devices.
- Many smartphones come with health and fitness applications, including step counters, calorie trackers, and heart rate monitors, contributing to users' well-being and fitness goals.
- It offers educational applications, e-books, and online courses, providing a portable and accessible platform for learning and skill development.

Tablets

A tablet is a mini computer with input, output and processing functions that are all combined into one device which, can be operated via 'touchscreen'. You can perform various tasks just by touching the screen. It is bigger than a smartphone and performs all the functions that can be done on a computer or a smartphone.

Difference between a smartphone and a tablet are:

	Smartphone	Tablet
Main Usage	Used as a phone with internet access, email, social networking.	Used as a wireless portable PC with a touchscreen. Some tablets use Android OS, others use Apple iOS or Windows OS.
Screen size	Smaller	Bigger than Smartphone
Photos and Videos	Watching a movie or making changes to a picture is difficult	Watching videos and making changes to a photo is better and easier due to bigger screen size
Battery Life	Shorter	Longer than smartphones
Storage	Comes with different storage capacities. Phones with higher storage are costly.	Usually have higher storage capacity, i.e., they can store more images, videos, and apps

TV and Radio

TV and radio have been used as an ICT tool for both entertainment and to learn new things. Radio is used to broadcast audio that includes news, songs, stories, speeches, cricket commentary, etc., while TV is used to broadcast audio-visual content to a wide audience. It is a powerful communication tool used for watching movies, news, weather forecast, songs, cartoons and educational lectures etc.

Applications or Apps

Mobile applications, commonly referred to as "apps," are software applications designed to run on mobile devices such as smartphones and tablets. These apps are developed for specific operating systems like iOS (Apple), Android (Google), or sometimes both. Some of the apps are already present on the phone or tablet. These are called "default" apps. Besides, there are hundreds of other apps that can be purchased and downloaded or downloaded free of cost from online stores like Google Play Store for Android and Apple App Store for iOS.

Some of the default apps installed on all smartphones are:

	Application	Functionality
	Phone	It stores contact details (name, phone number, etc.) of the people whose details you want to save in your phone. It also helps you to make calls and see recent calls details.
	Calendar	Shows a calendar and you can also add appointments, reminders, etc.

	Application	Functionality
	Camera	It allows users to capture photos and videos.
	Mail	An e-mail app to send and receive e-mails using your E-mail account in Gmail, Yahoo, Outlook, etc.
	Photos	Store all your photos and video and arrange them into albums.
	Map	This app helps you find directions to where you want to go. It uses GPS (Global Positioning System)
	Clock	It provides users with the current time, date,with additional features such as alarms, timers, and world clocks.
	Messages	This is for sending and receiving SMS messages.
	Web Browser	This allows you to open a browser to search and visit different websites.
	Music	This allows you to play and listen to songs and music.
	Google Play Store	This is the Google store from where you can get apps like Facebook, WhatsApp, etc. Some apps are free while some are paid ones.
	Apple Store	Apple devices have an Apple store where you can download and use various apps.

Mobile Device Layout

Some of the basic controls available on the Mobile Screen Layout are:

- **Power button:** It is used to start and shut down a mobile device.
- **Screen:** Can be customised with different apps and helps us perform functions with a touch of a finger.
- **Back button:** Helps you go back to the previous screen in an application.
- **Microphone:** This is present at the bottom of the mobile and we speak into the microphone when we talk to someone.
- **Menu button:** This is used to show the options available in a particular app. This may not be present in all mobile devices.
- **Home button:** This brings you back to the Home Screen from wherever you are on your mobile.
- **Earpiece:** This helps you to listen to voice calls.

- **Volume button:** This helps you to increase or reduce the volume of an audio in your mobile.

Basic Controls of a Mobile

Basic Features of a Mobile Device

Some of the basic features present in all mobile devices are:

	Feature	Functionality
	Bluetooth	This is a short-range wireless technology which helps you connect with other devices that are within 30 feet of where you are. Once connected, you can use internet and send messages.
	Chargeable Battery	It is a visual indicator that provides information about the current battery level and charging status.
	WiFi	It enables mobile devices to connect to the internet and local networks without the need for physical cable.
	Touch Screen	It provides an interactive display that allows users to control the device by directly touching the screen with their fingers or a stylus.
	Camera	It allows users to capture photos and videos.
	Clock	It provides users with the current time, date, with additional features such as alarms, timers, and world clocks.
	Cellular network connectivity	It establishes and maintains a connection with a cellular network, allowing users to access voice and data services.
	Global Positioning System	GPS in mobile devices is used for navigation and tracking their movements.

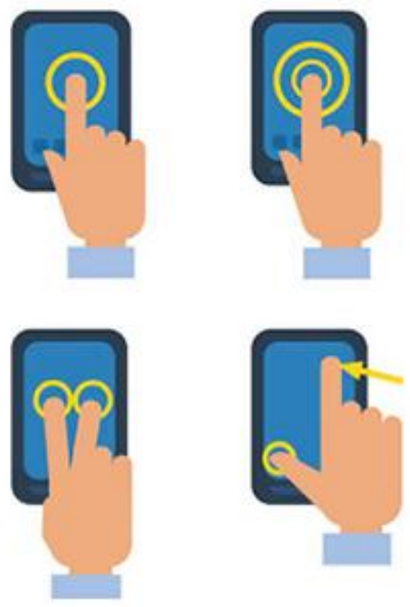
Home Screen of a Mobile Device

The home screen is the first (start) screen of a mobile device. There are three main parts of the home screen:

- **Status Bar:** It is the top part of the screen that displays icons like network signals, battery life, Wi-Fi, Bluetooth connectivity, 3G/4G status, etc.
- **App Icons and Shortcuts:** The central part of the screen is the main part with different App icons and shortcuts. These icons serve as shortcuts allowing users to launch their favourite apps with a simple tap. There can be several pages depending on the number of apps used.
- **Dock:** It is the lower part of the screen which contains apps that are always visible even if you change the page of the screen.

Basic Gestures used with the Touch Screen of a Mobile

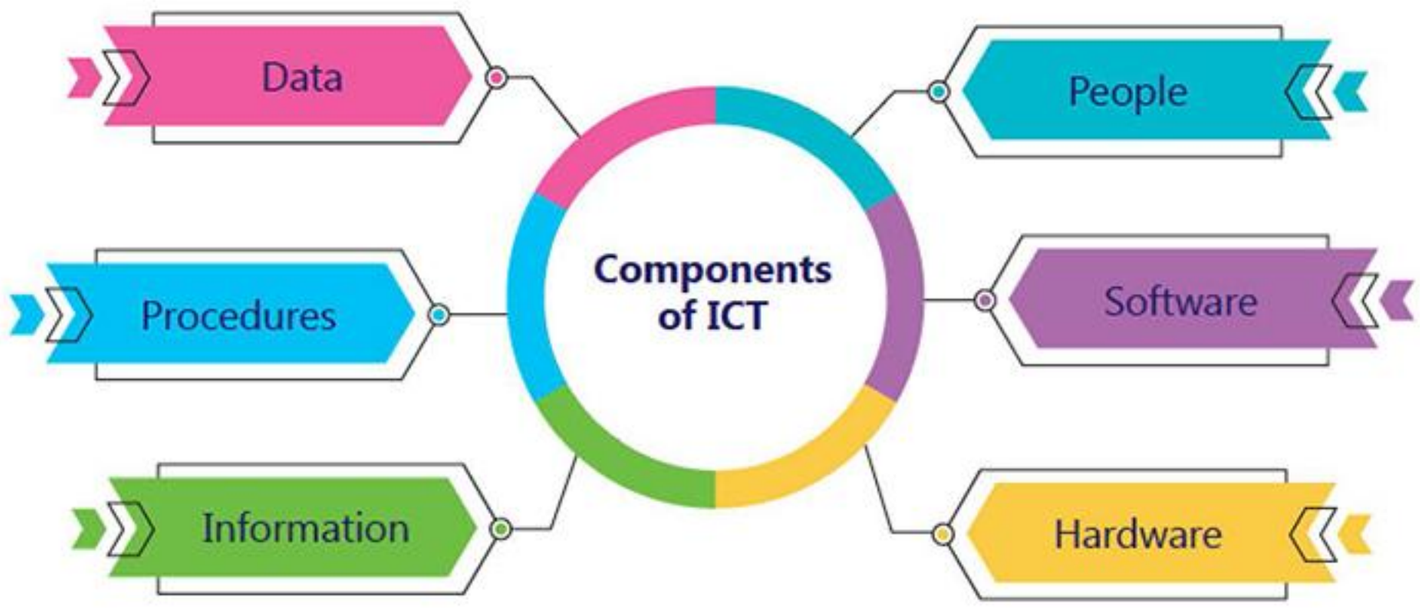
Gestures are movements made with the finger to interact with the touchscreen of your mobile device. For example, to open an App, you tap on the touchscreen. Some of these commonly used gestures' that can be used on the touchscreen are as follows:



- **Tap:** It is a quick touch or press on the screen that helps in selecting an item, opening an app, or activating a link.
- **Tap and hold:** This is similar to right-clicking your mouse, where you tap and hold your finger on the screen.
- **Drag:** To tap, hold, and move your finger across the screen.
- **Swipe:** Slide your finger to the right, left, up, or down on the screen, mimicking the action of turning a page.
- **Double tap:** To tap twice quickly. This will zoom out (increase the size of) of something. For example, to make a word appear bigger.
- **Pinch:** Put your thumb and finger together on the screen and bring it closer to zoom in (reduce the size). For example, to make a picture appear smaller.

Components of ICT

There are six components of ICT:



- **Data:** It is an individual unit that contains raw material given as input in ICT system. This data is interpreted to generate an information/processed data. For example, student marks of all subjects entered in a system.
- **Procedures:** These are methods used to pass data and information to people involved in ICT system. For example, using code designed in any specific computer language to generate a report card.
- **Information:** It is the processed data or output/result generated in ICT system. For example, generating report card of marks entered as data.

- **People:** People involved in giving input and generating output using the procedures. They use the generated information for the specific purpose. For example, marks entered by the teacher, report generated by staff of computer department in a school.
- **Software:** These are programs and applications used in ICT system. These are available both as front end and back end tools. For example, MS Word, MS Excel, and Visual Basic.
- **Hardware:** All physical components of the ICT system which we can touch and feel are called hardware. For example, Input Devices (Mouse and Keyboard), Output Devices (Monitor and Printer), Processing Device (Central Processing Unit) and Storage Devices (Hard Disk).

What is a Computer?

"Man is still the most extraordinary computer of all." —**John F. Kennedy**

A computer is an electronic device that takes an input from the user, processes it in a desired way and generates an output in a specific format. This processed data can also be stored in a storage device for future use. Computer as a term is not a single unit. It is combination of two major components:

- **Hardware:** All the physical components of a computer which we can touch and see are called hardware. They are visible parts of the computer. For example, keyboard, mouse, monitor, printer, motherboard, etc.
- **Software:** A set of instructions that we give to a computer to get the work done is called software. Let us take an example of our mobile phone. The mobile that we buy is hardware and the applications that we install on it are software.

  Software can be categorised in two types:

  * **System Software:** Software that is required to control the functions of a computer is called system software. It refers to a program that works as a manager of the computer.

    Without system software, we cannot use a computer. Some of the examples of system software are:

    - Operating systems like Windows, DOS (Disk Operating System), Mobile OS, MAC OS, etc.
    - Basic system utilities like disk formatters, file managers,etc.
  * **Application Software:** Software that is designed for a user and is made to do a specific kind of work is called application software. Some of the examples of application software are:
    - Microsoft Word and Open Office Writer are used for designing, editing and printing documents.
    - Spreadsheet is used for creating data in a tabular form so that data calculation, analysis and graphical representation can be done easily.

Basic Operations of a Computer

The computer performs four basic operations that are input, process, output, and storage. Let us discuss these in detail.

Input (Raw Data)

Input is the collection of raw facts or figures in the form of text, numbers, graphs, etc. provided to the computer using input devices like keyboard, mouse, scanner etc. It is also called raw data or unprocessed data.

Process

Process is a method to convert raw data into meaningful information. The Central Processing Unit(CPU) of the computer is responsible for processing of data.

Output (Information)

Output is the processed data. It is obtained after manipulation and processing of input (raw) data. It is also called meaningful data or Information. Computer displays the output to the user through output devices like monitor, printer, speakers, etc.

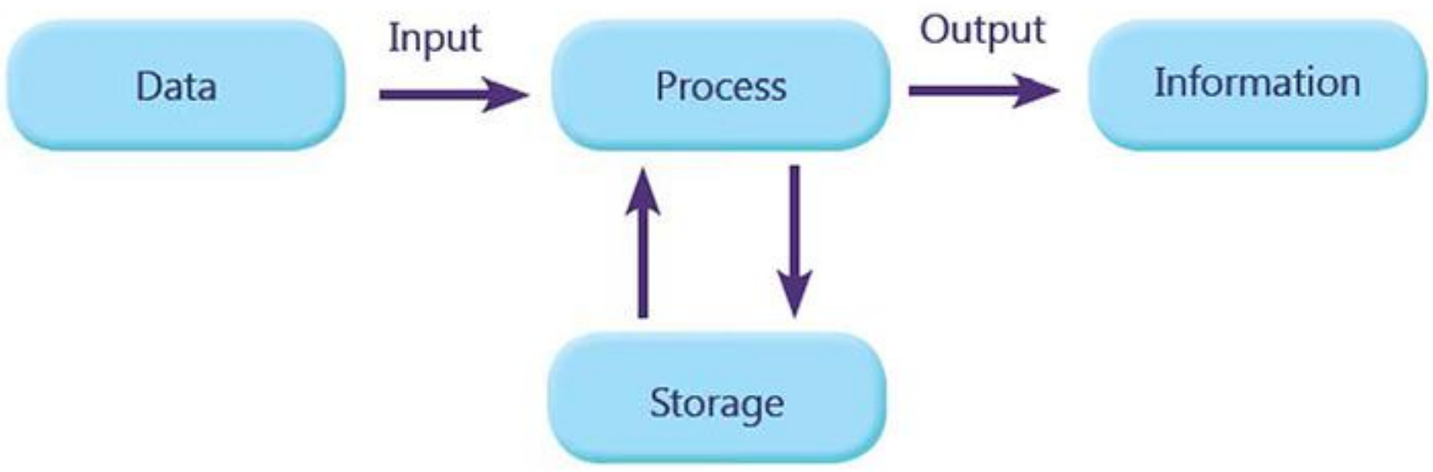
Storage

Storage is the process of storing either raw data or processed information. The data can be stored either using secondary storage devices like flash drive, hard disc, compact disc, or online storage medium like Google Drive, OneDrive, etc.

Input-Process-Output Cycle

All computing work revolves around three interrelated parts i.e., input, process, and output.

- An input is accepted by the user through the input devices.
- It is then processed by CPU and sent to the user as an output using output devices.
- There can be a need to store the output for later use in the storage devices.
- Sometimes the result generated acts as an input for the next stage of data flow.
- This flow of information follows a cycle which is known as the Input-Process-Output Cycle.



Characteristics of a Computer

Following are some of the important characteristics of a computer:

- **Speed:** A computer can process data at a speed of millions of instructions per second. It is faster than human beings in doing complex tasks which can otherwise take a few days to process manually. It uses its internal clock to measure the processing speed for completing the job. The unit of computer speed is Hertz, which equals one cycle per second.
- **Accuracy:** The information provided by the computer is very accurate. Sometimes we may feel that we are not getting the desired result or maybe the output generated is not accurate. When we give wrong input to the computer, the system malfunctions or gives wrong output. It works on the principle of GIGO(Garbage In Garbage Out).
- **Reliability:** Information received using a computer is highly reliable. During an online flight reservation, seat allocated to one person cannot be reallocated to another at any cost. So, we can totally depend on the availability of information of seats during online booking or availability of stock during online shopping.
- **Storage:** Large volumes of data can be easily stored in a small space. Data can be preserved for a long time with least possibility of data tamper or data loss. There is no need to maintain a huge volume of manual registers and separate store room allocation to it.
- **Versatile:** Computer doesn't mean a laptop or a personal computer. It can be a smartphone, tablet, online booking counter machine, ATM machine, X-ray machine in hospitals and GPS system in our cars. It is available in a variety of forms. So, we can say that it is highly versatile and has been designed to do any kind of job.

Input Devices

The devices which help to give data or instructions to the computer are called input devices. The most commonly used are keyboard and mouse. Let us learn about some of the input devices.

Keyboard

A keyboard is probably the mostly used input device which can be either wired or wireless. It is used to accept textual data from the user. It is impossible to imagine a computer without one. A typical keyboard has a typing area that includes the letters of the alphabet, numbers, punctuation marks, and other basic keys similar to that of a type writer.

Keyboard

Mouse

Mouse

A mouse is another input device which is also known as a Pointing Device. As you move the mouse, the pointer on the screen moves. A typical mouse has two buttons and a wheel. It can be either wired or wireless.

Scanner

A scanner is a device used to read the hand written notes, images, photos, and transfer it in a digital form onto the computer where it can later be saved or manipulated as per the requirement.

Scanner

Light Pen

Light Pen

A light pen is a pointing device shaped like a pen and is connected to a VDU. The tip of the light pen contains a light-sensitive element which, when placed against the screen, detects the light from the screen enabling the computer to identify the location of the pen on the screen. We generally use it to make a selection or draw anything on a screen.

Touchscreen

Touchscreen is the latest in the input devices where the input can be taken from the user through a touch of a finger, stylus, or a light pen on a display screen. We can give the entire set of commands by touching. Nowadays most of the laptops, Smart TV, smartphones, tablets, etc. also have touch screens where the use of the keyboard is minimised. It is a very useful and convenient alternative to a mouse or a keyboard in a graphical user interface.

Touchscreen

Microphone

Microphone

Microphone is a device that converts the sound received into a digital audio form which can be easily stored or manipulated in a computer.

Barcode Reader

A bar code is a set of parallel lines that appear on the products as their identification. You will find most of the packages having these barcodes that can be easily read by barcode readers. Bar code readers work by placing a beam of light on the lines that make up the bar code and detecting the amount of light that is reflected back. The barcode read is then stored in the computer for preparing invoices.

Barcode Reader

MICR

MICR

The bank account number and other details are printed onto bank cheques which are read by **Magnetic Ink Character Recognition** using a special magnetic ink. They are useful to find out whether the cheque is genuine or fake.

Web Camera

A web camera or webcam is a type of video camera that saves images or visuals in realtime into a computer via USB, Ethernet or Wi-Fi.

Web camera is used to create video links and helps us to set up authentic video conference stations. Some built-in webcams can be remotely activated from far-off locations. Webcams can also be used for security & surveillance purposes by monitoring the captured visuals.

Web Camera

Processing Device—Central Processing Unit (CPU)

After taking the input from the input devices, the information is sent for processing. The computer uses its brain to process the information. The computer's brain is called the CPU or Central Processing Unit. CPU is basically divided into three parts:

CPU Chip

- **ALU** stands for **Arithmetic Logic Unit**. It is responsible for all arithmetical and logical calculations.
- **CU** stands for **Control Unit**. It controls the flow of information in the system. The control unit is responsible for the flow of data from input devices to the processing unit and then to the output devices. It works like a traffic policeman who controls the traffic on the road.
- **MU** stands for **Memory Unit**. It is a storage unit that holds the processed or unprocessed data.

Output Devices

An output device is a physical component that converts the processed data or information into a human readable format.

Some of the commonly used output devices are:

Monitor (Visual Display Unit)

Monitor is a standard output device that is similar to a television screen. It is also known as Visual Display Unit (VDU) or console. An input from any input device such as a keyboard can be seen on the screen simultaneously. There are different types of monitors available in the market depending on the size and color.

Monitor

These days the most widely used monitors in computers, tablets, smartphones, Smart TV, etc. are LCD (Liquid Crystal Display). Its screen is made up of smaller elements called pixels. Resolution of any display unit is the number of horizontal and vertical pixels. A higher resolution provides a smoother, sharper, and clearer image.

Printer

A printer is an output device that is used to get the output on a physical medium like paper. The output on the screen is called a soft copy whereas the output from the printer is called a hard copy. It can be used to print both text and graphics. The two most common types of printers used these days are inkjet and laser printers.

Inkjet Printer

Inkjet Printer

Inkjet printers are also called photo printers. They are used to print both in coloured or black & white format for home or small business purposes. The speed of an inkjet printer is measured by the number of Pages Per Minute (PPM). Mostly inkjet printers print from 12 to 36 pages per minute.

Laser Printer

A laser printer works just like a photocopy machine that prints the output at high-speed and good quality. It creates images using a laser beam and powdered ink called toner. It is more expensive than inkjet printers and can be used for home or business purposes.

Laser Printer

Plotter

Plotter

A plotter is an output device similar to a printer but used to print vector graphics like architectural designs, maps, computer aided drawings etc. by plotting lines using a pen. A printer uses a technology of joining closely spaced series of small dots to print whereas a plotter draws using a pen. Multicolour plotters use different-coloured pens to draw in different colours.

Speakers

Speakers are an output device that produce sound waves in the form of an output which can be heard by a listener. Speakers can be attached to a computer or to any other system like smartphones, tablets, Smart TV, etc. to enhance the volume and the quality of audio output. The different kinds of speakers range from simple, two-speaker output devices to surround-sound multi-channel units.

Speakers

Projector

Projector

A projector is a display device that projects a computer screen onto a flat surface, like a whiteboard or wall. It is most commonly used in home theaters or in organisations for official presentations.

Computer Memory

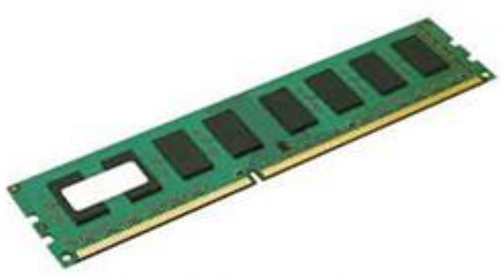
Computer memory holds raw data before it goes for processing and after processing it contains information which can either be sent to output devices or stored in secondary storage devices for future use. There are two types of memory in the computer— primary memory and secondary memory.

Primary Memory

This type of memory is necessary for a computer to work. It is also called the Internal Memory. This is the actual place where the data is stored before it is taken to ALU for processing. Primary memory is of two types: RAM and ROM.

RAM (Random Access Memory)

It is temporary in nature. The computer holds information in this memory and gets it when needed. It remembers what you tell them and can even change to remember new information. It is volatile in nature, which means that data will be erased when the computer is turned off. That's why you always save your work! RAM is considered "random access" because any part of it can be accessed randomly for reading or writing of the data.



Random Access Memory

Read Only Memory

ROM (Read Only Memory)

It is permanent in nature. It is non-volatile which means its contents remain even after the computer is turned off. The information is coded at the time of manufacturing the computer. The computer needs this information for its basic functions.

Secondary Memory

Secondary Memory provides extra storage where the data can be stored permanently for later use. It is also known as external memory as it can be stored anywhere. Examples of secondary memory are compact disc, hard disc, flash drive, etc.

Hard Disk

A Hard Disk stores and provides quick access to large amounts of data on an electromagnetically charged surface or set of surfaces. Hard disks are generally fitted inside the system unit. However, there are external hard disks also available. A hard disk is made-up of a collection of disks called platters stacked on a cylindrical rod. Each of which, like phonograph records, has data recorded electromagnetically in concentric circles or "tracks" on the disk. The capacity of a hard disk varies from a few Gigabytes to a few hundred Terabytes.

Hard Disk

CD

CD

A compact disc is a small, portable, round disc made of molded polymer used for recording, storing, and playing back audio, video, text, and other information in the digital form. It was originally developed to store sound recordings exclusively, but later it also allowed the preservation of other types of data. It stores data of low capacity upto 700 MB.

DVD

Digital Versatile Disk is used for storing digital data using optical rays. It is the same size as a CD, but has a larger storage capacity. They are commonly used to store large volumes of data including audio and video files. It stores data upto 10 GB.

DVD

Blu-ray Disc

Blu-ray disc is of the same dimension as that of CD or DVD and uses the same optical rays technology for recording and playing back high-definition (HD) video and for storing large amounts of data. It has a capacity of up to 25 GB.

Blu-ray Disc

Flash Memory

Flash drive functions as a portable hard drive. It's a small and portable memory card that plugs into a computer's USB port. USB flash drives are smaller and more durable with large storage capacity. It can be used in any computer with USB port. USB flash drives are also called thumb drives, pen drives, key drives, or simply USB drives. It stores data upto 2 TB.

Flash Drive

Memory Stick

Memory Stick

Memory stick is a portable memory card used as an add-on for smartphones, digital cameras, SmartTV etc. its capacity varies from 4 GB to 128 GB.

Measuring Unit for Memory

The unit used to measure data stored in memory or storage devices is the byte. In computing, a byte for memory is equivalent to a kilometer for distance, a second for time, or a kilogram for weight.

Computers work in binary digits— 0 and 1 to form endless combinations of 8 bits(1 Byte). This byte represents a single letter, number, punctuation, or any other special character on the keyboard. These bytes combine in different forms to represent data.

- **Bit:** A bit is the smallest measuring unit. It can be either 0(Off) or 1(On).
- **Byte:** A byte is the basic unit for measuring units. It is made up of 8 bits.

To represent huge data we have different units to measure as listed below:

1 Byte	8 Bits
1 Kilobyte (KB)	1024 Bytes
1 Megabyte (MB)	1024 KB
1 Gigabyte (GB)	1024 MB
1 Terabyte (TB)	1024 GB
1 Petabyte (PB)	1024 TB
1 Exabyte (EB)	1024 PB
1 Zettabyte (ZB)	1024 EB

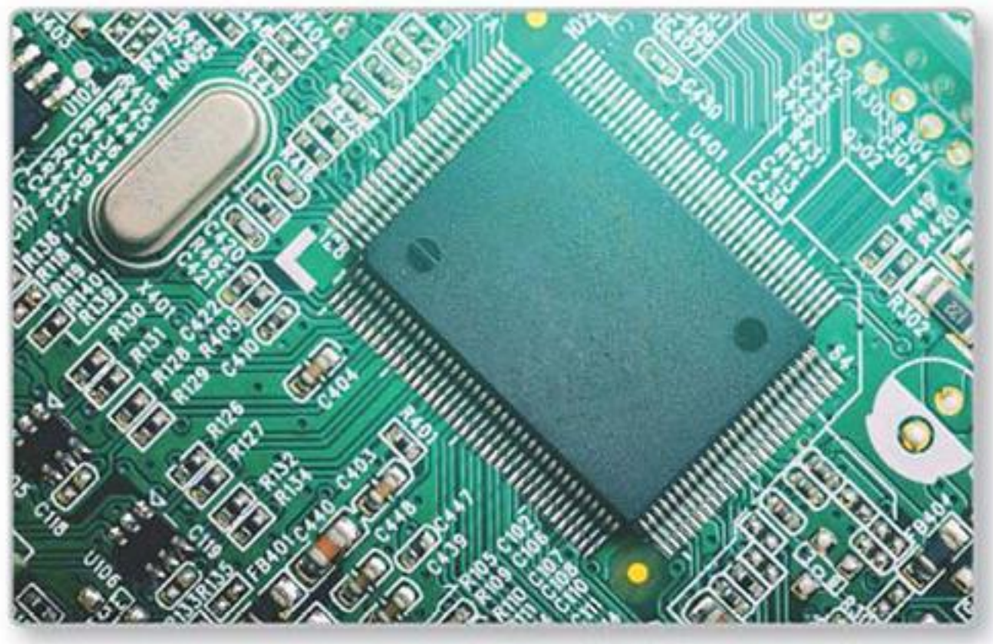
Peripheral Device Ports

These ports act as a connector or a point of attachment between the external peripheral devices like mouse, printer, keyboard, camera, scanner, etc. and the computer. There are different types of ports present in a computer system. Some of the commonly used are discussed below:

- **Serial Port:** In Serial port data transmission between the computer and the peripheral device takes place in a sequence of one bit at a time. It was used to connect mouse and external modems in older times. Nowadays it is replaced by a USB port.
- **Parallel Port:** In Parallel port data transmission between the computer and the peripheral device takes place in a parallel line of eight bits at a time. It is used to connect scanners and printers.
- **USB Port:** Universal Serial Bus is a new technology port which supports the connection of a variety of devices like scanners, printers, keyboard, cameras, speakers, etc. to the computer. It is much faster than serial or parallel ports. Smartphones, Tablets, e-book readers use USB port for charging.
- **Ethernet Port:** Ethernet Port provides a network connection by connecting the ethernet cables to the computer for network and Internet connectivity using wired technology.
- **HDMI Port:** High Definition Media Interface port is used to connect high quality audio and video devices like MP3 players, cameras, smart phones, Tablets, Smart TV to computers. It helps in the transmission of good quality audio and video files.
- **Power Port:** It is used to connect the system to the power supply.

Motherboard

Motherboard or the main board consists of a board containing electric circuits that connects all the important components of the computer. If the CPU is the brain of the computer, then, the motherboard is the central nervous system making it the backbone or spine of a computer system. It consists of:



Motherboard

- Ports to connect different input and output devices.
- Memory slots that contain the system's main memory.
- ROM-BIOS chip that acts as an interface between the operating system and the hardware of a computer.
- System Clock that synchronises all the components of the motherboard.
- Power connector that gives power supply to all the essential components on the motherboard.

Understanding Operating System

An Operating System is a system software which acts as an interface between the user and the computer. It is an important component of a computer system which controls all other components of the computer system. It helps us to communicate with the computer without knowing its language. Without an Operating System the computer is of no use. Some of the commonly used Operating Systems are Windows, DOS, UNIX, Ubuntu, MacOS etc. Mobile devices also have operating system that help them perform their functions. For example, Apple iOS and Google Android.

Operating System

Some of the operating systems are explained below:

UNIX

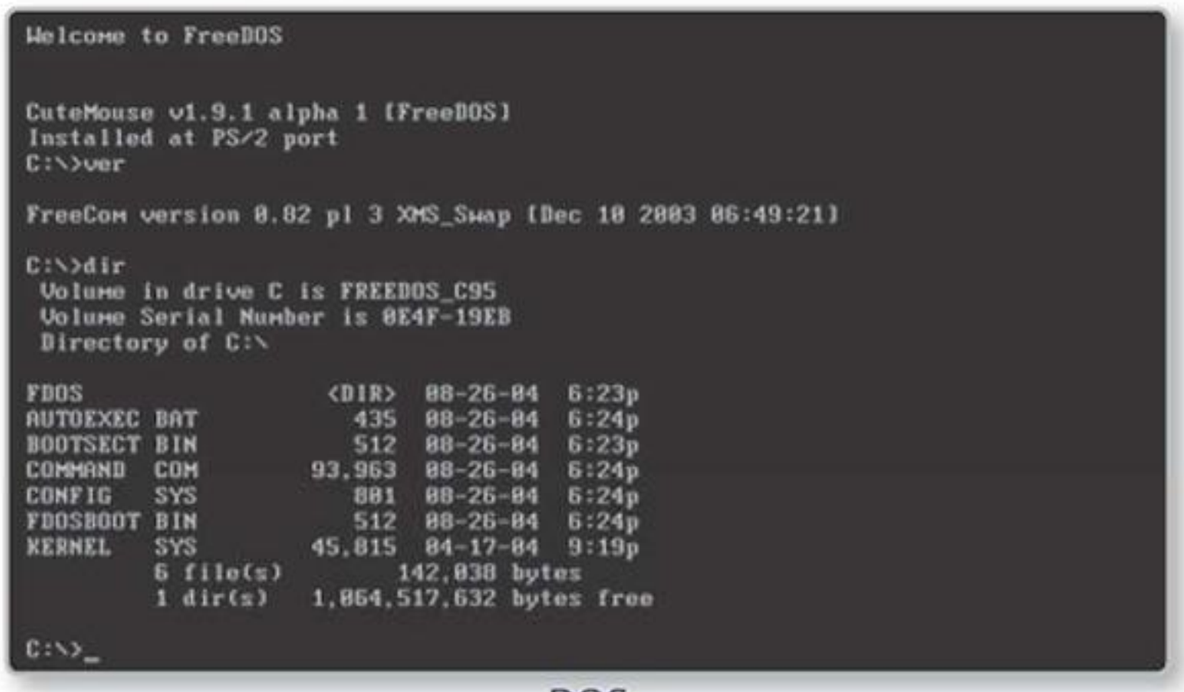
Unix

Unix is one of the oldest, reliable, and powerful Operating Systems developed at AT&T's Bell Laboratories in the early 1970's. It has a simple user interface called Shell, which interacts with the kernel to execute tasks. Some of its important features are:

- It has a character user interface.
- It supports multiuser and multitasking. Several users can run multiple programs or processes simultaneously on one system.
- It has machine independent architecture written in high level language.
- It has a hierarchical file system to represent information.

Disk Operating System (DOS)

After UNIX, DOS is one of the most commonly used Operating Systems. It was written originally by Tim Patterson— Father of DOS and owned by Seattle Computer Products. Microsoft released it with an IBM PC as MS-DOS 1.0 in 1982. It has the following important features:



DOS

- It is a single-user operating system.
- The user interacts with the OS in a text mode environment.
- It does not support a graphical interface, so the mouse cannot be used as an input device.
- Basic file management functions like creating, renaming, copying, moving, deleting, etc. can be easily performed at "Command Prompt".

Windows

The first version of Windows, launched by Microsoft in 1985 which was an extension of the Disk Operating System. The most important change is the support of Graphical User Interface where mouse as an input device played a very important role. Following are some of its important features:

- Initial versions supported single user at a time but now new versions support both single user and multi users at a time.
- It has multitasking features.
- It has a Graphical User Interface where the user can get its work done by a few simple mouse clicks.
- It provides easy access to the Internet.

Some of the famous versions are, Windows 3.0, Windows 95, Windows NT, Windows 2000, Windows7, Windows 8.1, Windows 10 and the latest in the market is Windows 11.

Brainy Fact

Windows 95 was the second most installed system software on computers in 1995, video game Doom was first.

Linux

Linux is an open source operating system having UNIX like features. It was originally created by Linus Torvalds in 1991. It is also known as the Operating System of the future.

Some of its important features are:

Linux (Ubuntu)

- It has a graphical user interface.
- Free and open source operating system. Anyone with GNU General Public License (GPL) can run, modify and even sell the software.
- It supports multiuser and multitasking. Several users can run multiple programs or processes simultaneously on one system.
- It has a hierarchical file system to represent information.

Different variants of Linux are available in the market like Red Hat, Ubuntu, Arch Linux etc.

Brainy Fact

Only 2 out of top 500 Supercomputers run on Windows, while 485 run on Linux.

Mobile Operating System

Mobile Operating Systems are designed to run the applications and other programs on smartphones, tablets, smart watches or other portable devices. It is a combination of an operating system and communication technology.

Some of the important features are:

- It has a graphical user interface with menus and buttons supporting different types of apps.
- It has a strong multitasking feature.

- It allows a device to easily interact in short distance or long distance communication.
- Some of the commonly used mobile OS are Android, iOS, etc.

Android

iOS

Booting

Booting is a process of starting the operating system and loading it in the computer's memory when the power is switched on. It is of two types:

- **Cold Booting:** After the computer is shut down completely followed by power off and then we switch it on to start it, then, it is called cold booting.
- **Warm Booting:** It is when we press the Restart button without switching off the power supply and the computer is reloaded with all its operating system files.

Procedure for Starting a Computer

When the power button is switched on, Windows 11 follows the given Start up Process:

- As soon as the power is on, **ROM** loads the **BIOS** instructions into the computer's memory.
- It does **Power On Self Test** to check that all the hardware devices are functioning properly with constant supply of the electricity. In case there is any error, a beep sound is produced, an error message is displayed on the screen and the system stops loading windows.

Login and logout

The term "login" refers to the process of accessing and entering a user account to access the user's personalised desktop environment. It involves the steps necessary for providing the credentials details like username and password etc. so that an authenticated person will gain access to the operating system. A login ID and password is like a key to the lock which allows you to use the computer.

The login process is the initial step after starting or restarting a computer. The steps involved in login:

Step 1 Windows will display a sign-in screen where you can see a list of user accounts or enter your username/ email and password.

Step 2 Windows will verify your credentials against the information stored for the selected user account.

Step 3 Upon successful authentication, Windows will load your personalised desktop and launch background processes.

Step 4 You are now logged in, and your user session begins.

Logging out is an essential step for security and privacy, as it ensures that unauthorised users cannot access your account or data after you have finished your session. When you log out, you terminate your current user session, and access to the system or application is restricted until you log in again.

The steps involved in logging out of Windows 11 will be:

Step 1 Click on the Start menu or press the Windows key on your keyboard.

Step 2 Click on your profile icon or user account picture located at the top of the Start menu.

Step 3 In the menu that appears, click on Sign out or Logout.

The steps involved in Windows Boot Process are as follows:

Step 1 **Windows Loader** will do an initial setup to load windows kernel into the computer's memory (RAM).

Step 2 After this, the Operating System will take over the whole process of controlling and configuring the system.

Step 3 After the system configuration is done System Utilities and Antivirus will become active to participate till the system is on.

Step 4 Session Manager will take over and the system is ready for the authentication process to display the user name and password screen.

Step 5 If the valid username and password is entered, then, the Desktop is displayed and the computer is ready to use.

Windows 11—An Operating System

Windows 11 is Microsoft's latest operating system, succeeding Windows 10 with a sleeker and more modern interface. It features a centered Start Menu and Taskbar, along with rounded corners and smoother animations throughout the system. Enhanced multitasking capabilities are introduced with Snap Layouts and Snap Groups, allowing for easier window management. The Microsoft Store has been redesigned to offer a curated selection of apps and games, including support for Android apps via the Amazon Appstore. Overall, Windows 11 aims to provide a more intuitive and enjoyable user experience while leveraging modern hardware capabilities.

Components of Windows 11

When we switch on the power button of a computer, then, the system boots and displays the first screen popularly known as Desktop.

Let us look at the different components of Windows 11.

Desktop

Desktop is the area that occupies almost the whole screen. It contains:

- **Background:** Default background wallpaper which can be changed to user defined anytime.

- **Icons:** Some default icons like—My Computer, Network, User folder, Recycle bin are already present. Some other icons can be added or removed as per the need.
- **Programs:** Shortcut of some of the programs installed in a computer can be added to the desktop for quick and easy access.

Taskbar

Taskbar is the thin strip present at the bottom of the screen. By default it is always visible at the bottom but we can choose the auto hide option in the taskbar settings which will hide the taskbar. But it will reappear only when the mouse cursor moves down to that area.

Windows 11 Taskbar

Taskbar contains the following important components:

- **Start button:** It is a small button with a window logo present on the left corner of the taskbar. It provides access to all commands, programs and applications installed in a computer.
- **Quick Launch Program Icons:** There is a set of few program icons made available in the taskbar for its immediate access without getting into the hassle of going through different menus and sub-menus. It also displays small pop-up rectangle windows of the already opened programs. We can easily add and remove programs in this taskbar by following the given steps:

Step 1 Select the program from start menu.

Step 2 Either drag or drop on the taskbar or right click on the program and select "Pin to Taskbar".

- **Notification Area:** This area in earlier versions was known as System Tray. It displays the system notifications and the status of the other tasks running in the background. It has:
  * **Speaker:** This icon looks like a loudspeaker. It allows quick access to your computer's volume settings.
  * **Power:** It displays the power cord icon if connected to power otherwise total battery life in % is visible.
  * **Network connection:** It displays the network connectivity status.
  * **Antivirus program:** It displays the active status of antivirus if installed in a computer.
  * **Windows update notification:** It notifies a user about Windows updates available for download and installation.
- **System Clock:** It is present at the right corner of the taskbar. It displays the system's date and time.
- **Show Desktop Button:** It is a thin rectangular vertical bar present just after the system clock at the right corner of the taskbar. If multiple windows are open, then, we can simply display the desktop area by placing the mouse pointer on it. The shortcut key to display the desktop when you are working in multiple windows is Windows Key + D.

Common Desktop Operations

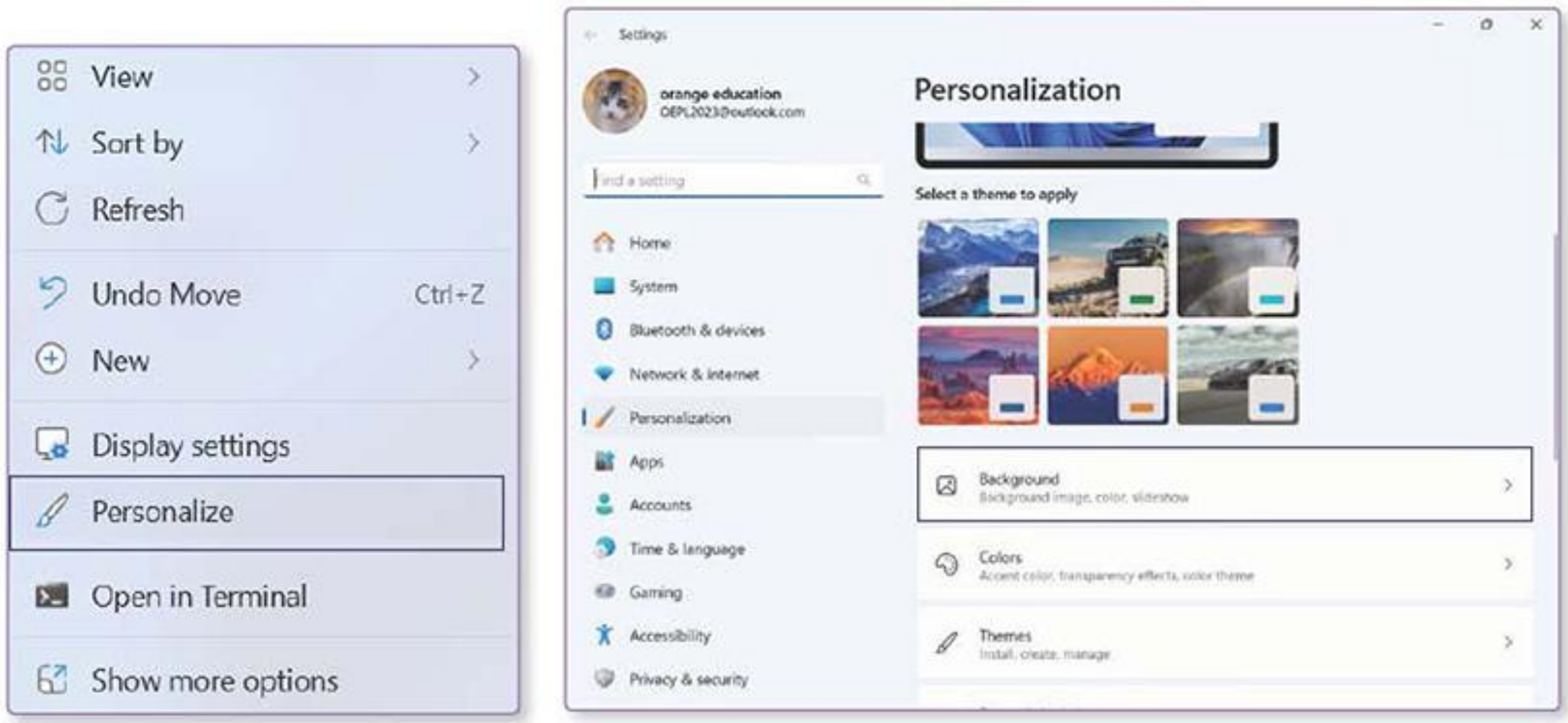
We can perform different types of operations on desktop. Let us learn about some of them.

Changing Wallpaper

The image or pattern that appears behind the icons on the desktop is called the 'wallpaper'. We can easily change this default wallpaper into personalised form by doing the following steps:

Step 1 Right click on any area of desktop. Select the **Personalize** option from the pop-up menu.

Step 2 Select **Background** option.



Step 3 Select any available picture present in the window or browse to your personal folder and select any picture.

Step 4 Click on save changes.

Step 5 Exit the window and you will see the selected picture as the new wallpaper of your desktop.

Setting Screen Saver

If a computer is not used for a specific period of time, then, some sort of text or pattern appears on the screen to show that the processor is idle. This is known as a screen saver. The screen saver disappears as soon as a mouse clicks or any key is pressed.

The time and the content of the screen saver can be easily set by following the given steps:

Step 1 Right click on any area of desktop. Select the **Personalize** option from the pop-up menu.

Step 2 Select the **Lock Screen** options.

Step 3 Select **Screen Saver** option.

Step 4 Click **Screen Saver drop-down list** and choose a screen saver.

Step 5 Click **Preview** to see what your chosen screen saver will look like.

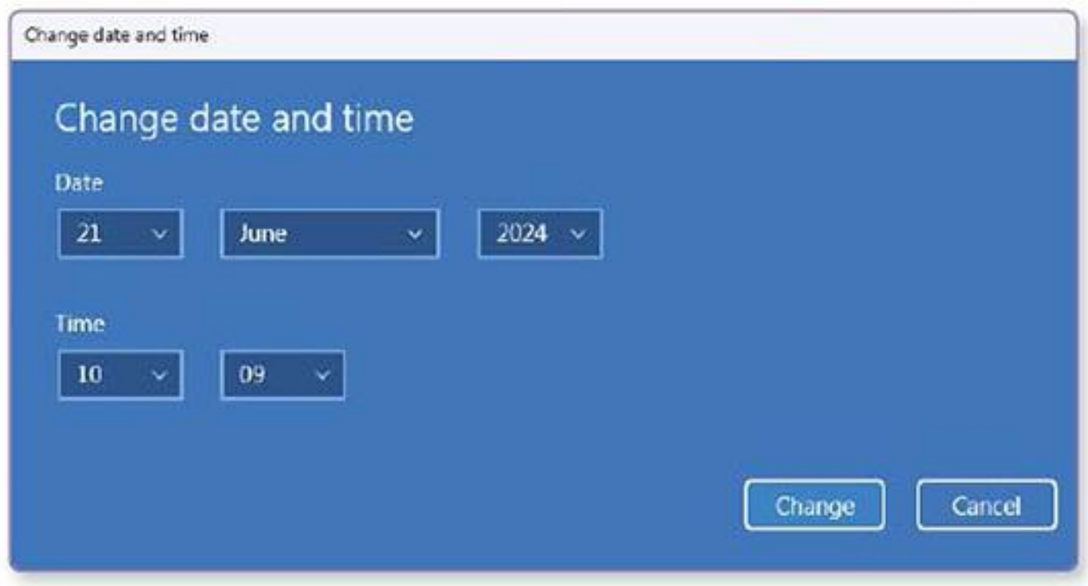
Step 6 Create your own screen saver by choosing "**3D Text**" option in screen saver settings.

Step 7 Set the **timings in minutes** to fix the appearance of screen saver.

Step 8 Click on **Apply** and then click **Save**.

Changing System Date/Time

System Date and Time appears on the right corner of the taskbar. We can change the default setting by doing the following steps:



Step 1 Right-click on the time in the right corner of taskbar to display a pop-up menu.

Step 2 Select **Adjust date and time** from the pop-up menu.

Step 3 Select the **Set time automatically** toggle to turn it **Off**, then select **Change**. **Change date and time** dialog box will be open.

Step 4 Do the required changes in the system date and time.

Step 5 Click on **Change**.

Controlling Speaker Volume

It is used to control the volume of the computer speaker to make the sound audible to the user.

Step 1 Click the speaker icon on the lower right corner of the taskbar.

Step 2 Change the volume by moving the slider left or right.

Files and Folders in Windows 11

File is defined as a program that stores the data organised in a specific format. It can be an executable (exe) file for running a program, a Word document, a spreadsheet, an audio, a video or a program written in any programming language. Each file in a computer has a unique name. This name is divided into two parts:

- **Primary name:** It can be any name given by using standard naming conventions. It can contain letters, numbers and special characters.
- **Secondary name or Extension:** It tells us the category of the file and is automatically assigned by the program where this file is created. For example, an audio file has an extension of .mp3, an Excel file has .xlsx, a Word file has .docx, etc.
- A folder is a directory created for storing the related files or subfolders under a specific name.

Managing Files and Folders in Windows 11

Windows 11 allows us to organise our files and folders in a well managed hierarchical structure using a special program called **Windows Explorer**. It displays all the disk drives, folders, subfolders, and files on our computer system. We use Windows Explorer to find, copy, delete, launch, and even configure programs and documents.

The Windows Explorer displays the content in a hierarchical form divided into two sections:

- **Left Section** shows the directory tree, containing the list of folders and subfolders that we have on our system. On this side only folders and sub folders appear but no files such as Desktop, Documents, downloads, etc. appear.
- **Right Section** displays the content of the folder that we have opened on the left section. This section shows its subfolders and files. Depending on the type of view that we have activated, we will see different types of information regarding the files.

There are three different ways to access File Explorer:

Method 1: Select the Windows File icon on the Taskbar.

Method 2: Right click on Start Menu and select Windows Explorer.

Creating a File

Perform the following steps to create a file:

Step 1 Select the location where you want to create a file.

Step 2 Right-click in a blank space. A pop-up menu appears.

Step 3 Select the New option. A sub menu appears.

Step 4 Select Microsoft Word Document option. A new word file gets created with the default name.

Step 5 Delete the default name and write your own user defined name and press the Enter key. Your file has been created.

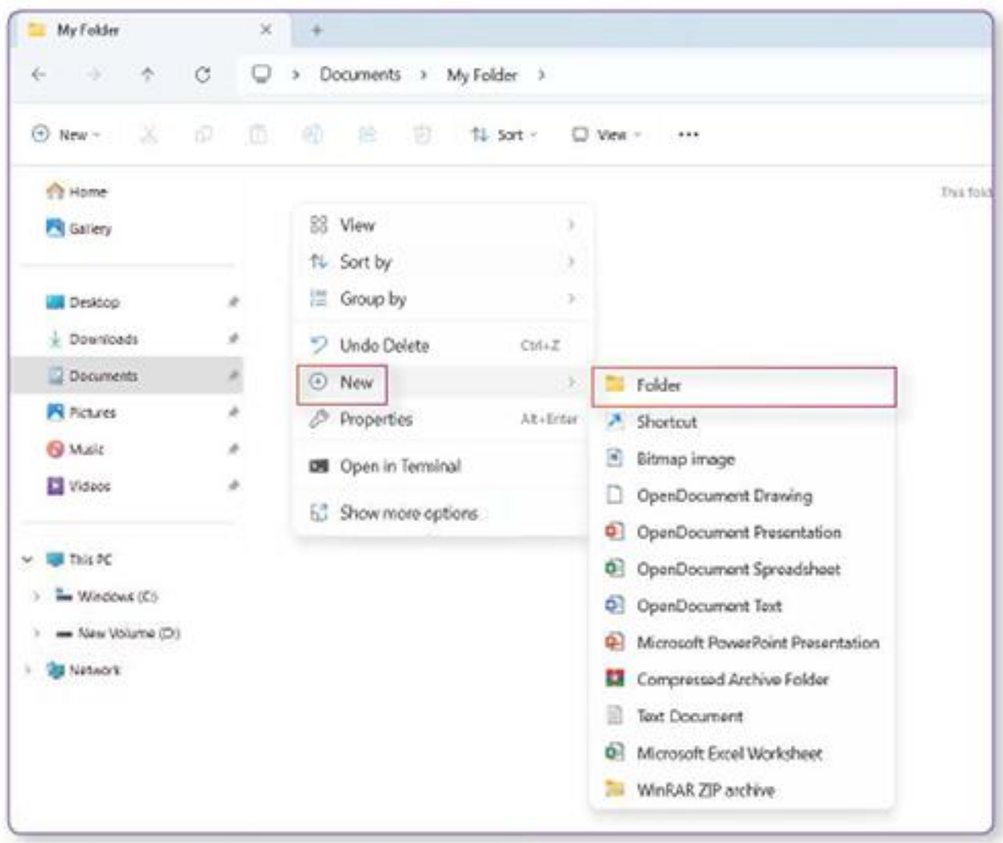
Creating a Folder

Perform the following steps to create a folder:

Step 1 Select the location where you want to create a folder.

Step 2 Right-click in a blank space. A pop-up menu appears.

Step 3 Select the New → Folder option. A new folder with the default name "New Folder" will appear.



Step 4 Cursor blinks on this new folder. Delete this name and assign a new relevant name to this new folder created.

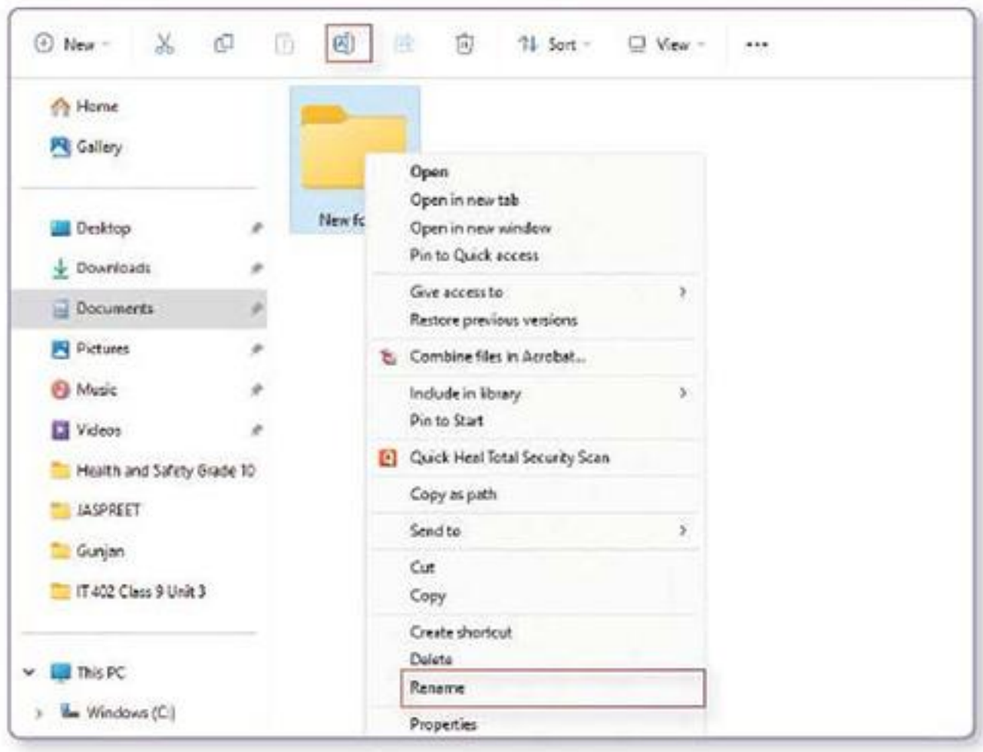
Renaming a File/Folder

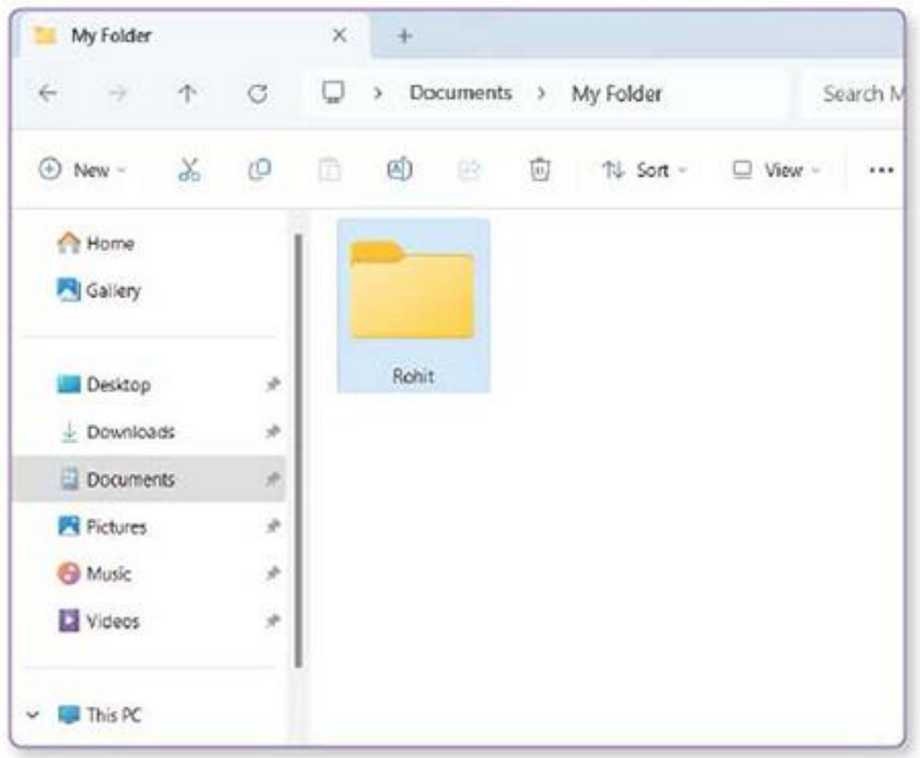
Perform the following steps to rename a file/folder:

Step 1 Right-click on a file/folder which you want to rename. A pop-up menu appears.

Step 2 Click on the **Show more options**, then select the **Rename** option. The file/folder name gets selected.

Step 3 Press the delete key and type the new name and then press the Enter key. The file/folder gets renamed.





Deleting a File/Folder

Perform the following steps to delete a file/folder:

Step 1 Select the specific file/folder.

Step 2 Press the Delete key. The file/folder gets deleted and goes to the Recycle Bin. You can restore the file from Recycle Bin later if needed.

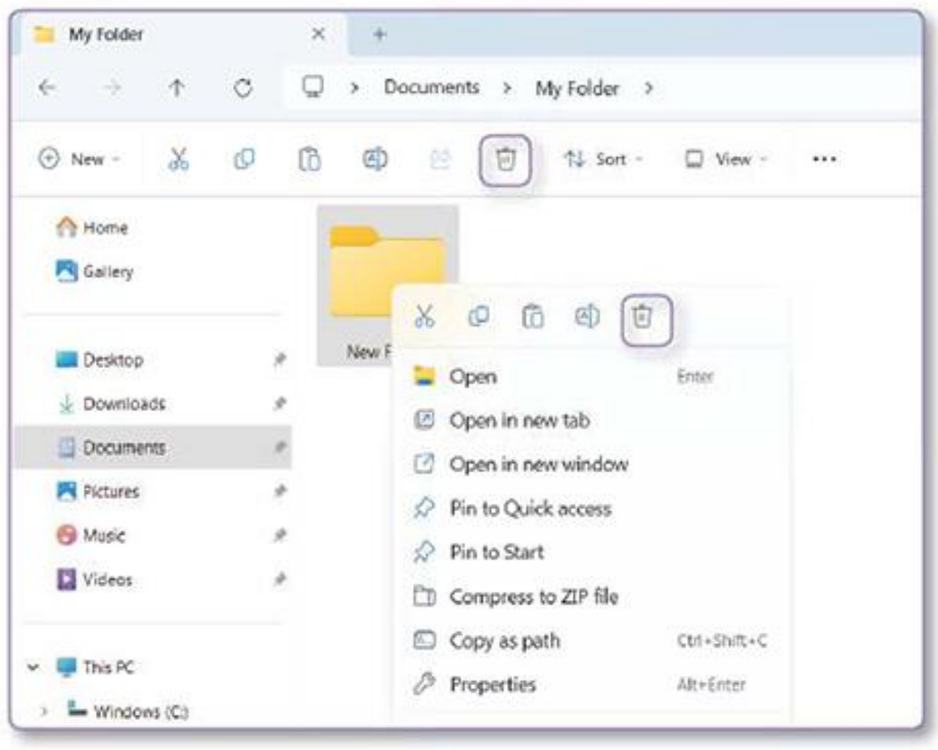
OR

Step 1 Select the specific file/folder.

Step 2 Right-click on the file/folder a drop down menu appears.

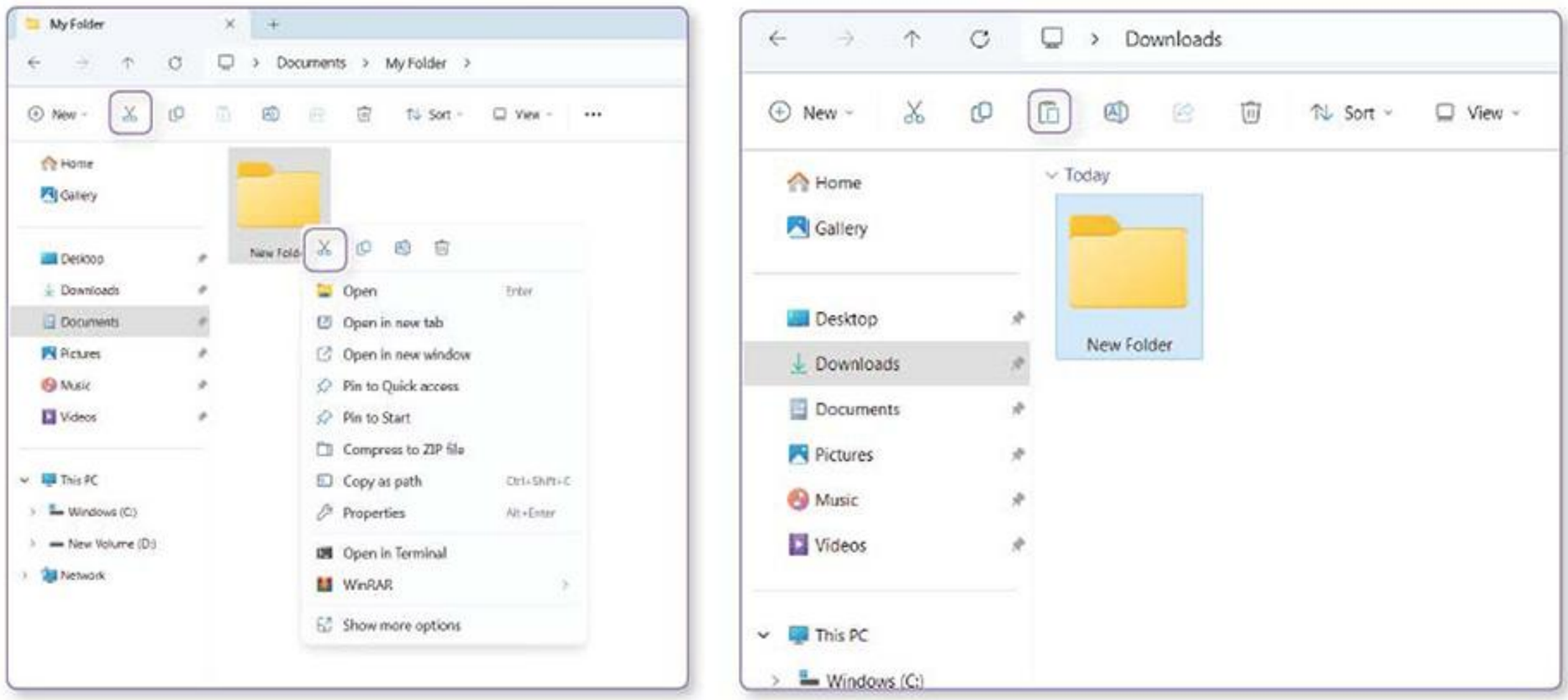
Step 3 Click on **Delete** icon.

Step 4 To remove the file permanently **Shift + Del**



Moving a File/Folder

Perform the following steps to move a file/folder:



Step 1 Select a specific file /folder.

Step 2 Drag it to a specific location and drop it to move the file.

OR

Step 1 Right-click on the file/folder which you want to move. A pop-up menu appears.

Step 2 Select the **Cut** icon.

Step 3 Move to a specific location where you want to shift the file and right-click in the blank space and select the **Paste** icon. The file will be removed from its original location and moved to the new location.

Copy and Paste a File/Folder

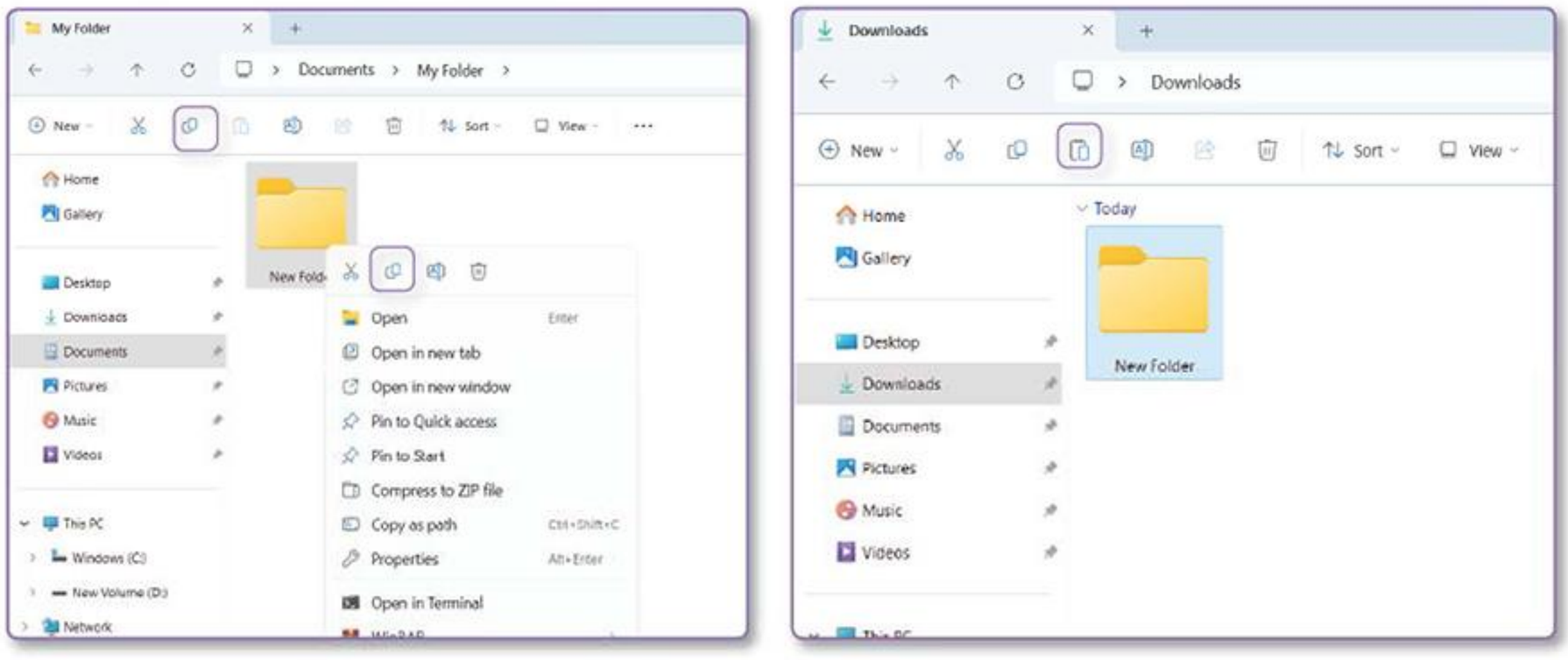
Perform the following steps to make a copy of a file/folder:

Step 1 Right-click on the file/folder which you want to copy. A pop-up menu appears.

Step 2 Select the **Copy** icon.

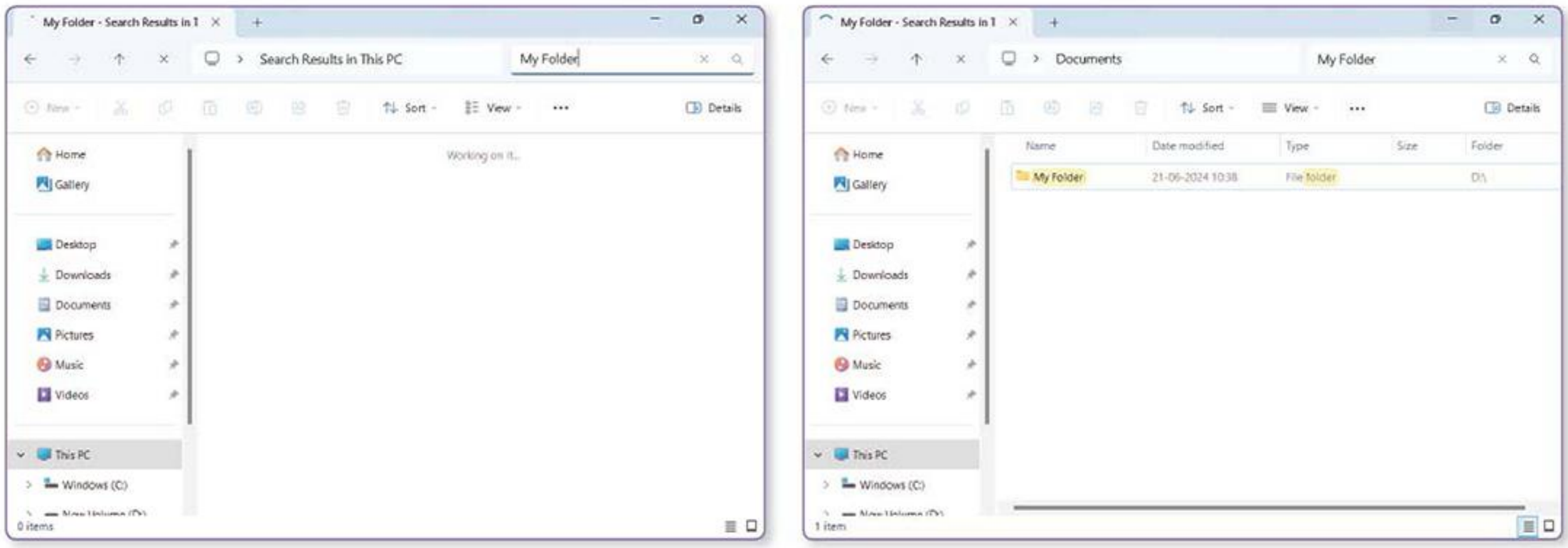
Step 3 Move to a specific location where you want to make another copy of the same file/folder.

Step 4 Right-click in the blank space and select the **Paste** icon. The file appears on the new place. However, it also exists on its original place.



Searching a File/Folder

Type a file name or a folder name or keyword related to the file you wish to search in the search bar located at the top-right corner of the Windows Explorer. Even before you finish typing the search keyword, Windows Explorer will start displaying the list of the files matching the search criteria.



Mouse Operations in Windows 11

Mouse is an important input device in a graphical user environment like Windows where the user has to do simple mouse clicks to get the job done. Windows 11 is designed to make the mouse easier to use. Let us now see how useful this pointing device is in Windows 11.

Single-click

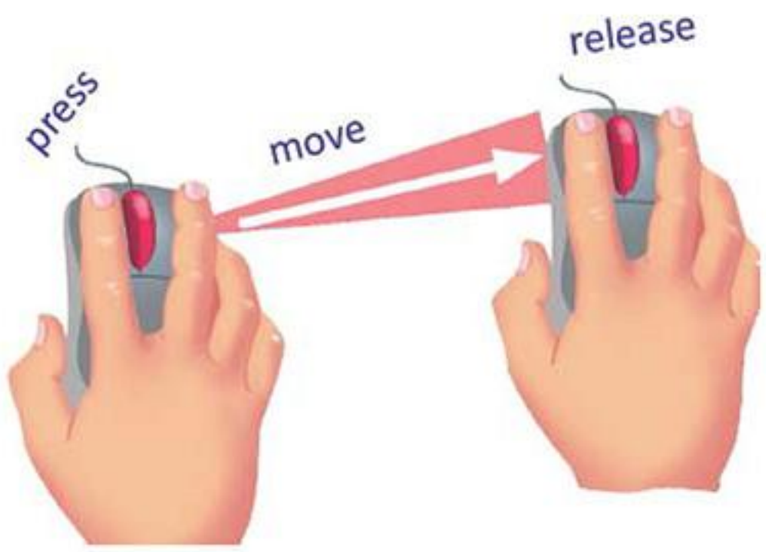
This is the most common task performed by a mouse in Windows 11. We can select a program, file, folder, menu, sub-menu, option, etc. using a single left mouse click. Whichever option is to be selected, move the mouse pointer to point to that area and do a single left mouse click to select that option.

Double-click

When we use the left button to click twice in quick succession, then, it is called a double click. We generally use double click to open a file/folder, to open a specific program or application software.

Right-click

To display context based pop-up menu or shortcut menu, we use the right mouse button click. For example right clicking on a cell in a spreadsheet gives you important formatting features of the cell.



Drag and Drop

Drag and Drop is used to shift the location of a file, folder or a program. We select an object and press the left button down. Without releasing the mouse button, drag the object to a new location and release the mouse button to drop it onto a new location.

Hovering

Hovering means moving a move cursor over an option or an object without clicking it. This action can trigger certain responses from the operating system or software applications, such as displaying tooltips, changing the cursor shape, or highlighting the element.

Keyboard Operations in Windows 11

Keyboard is a standard input device. In graphical user environment, the use of keyboard is limited to enter data using text, numbers, punctuations and special characters. However, some of the basic control functions performed by mouse can also be handled using keyboard combinations to speed up the work. Commonly used basic keyboard operation commands are listed below:

Shortcut keys	Task to be performed	Shortcut keys	Task to be performed
Ctrl+N	Creating a new file	Ctrl+X	Cut
Ctrl+O	Open a file	Ctrl+V	Paste
Ctrl+S	Save a file	Ctrl+F	Find option
Ctrl+P	Print	Ctrl+C	Copy

Shutting down the Computer

After we are done with our work and we are in no need to use a computer, then, it is always advisable to do proper shutdown of the system. Shutting down a computer means sending all the operating system files back to the hard disk and saving all the work into a proper secondary storage device followed by switching off the power supply to all the important components of the computer.

The steps to shut down a computer are:

Step 1 Click on **Start** button. The **Start** menu appears.

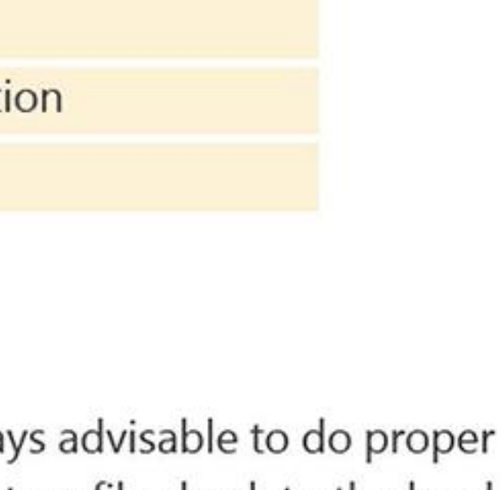
Step 2 Select the **Power** button in the bottom-right corner.

Step 3 Select **Shut down** option.

OR

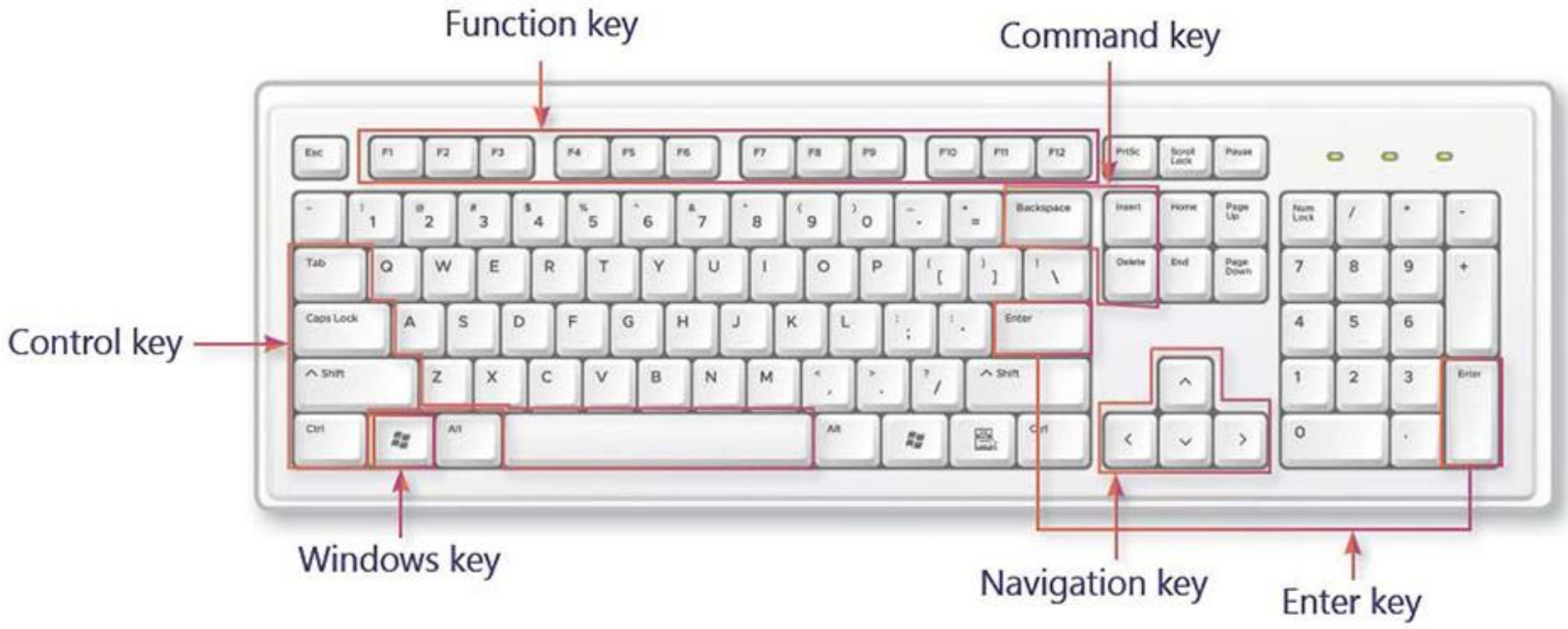
Step 1 On the desktop, press Alt + F4 keys. It will display the **Shut Down Windows** screen.

Step 2 Select the **Shut down** option.



Using Keyboard

A keyboard is an input device used to type text, numbers and commands into the computer, as shown in Figure



Function keys

Keys labelled from F1 to F12 are function keys. These are sets of keys on a computer keyboard that perform specific functions within software applications and the operating system. Their functions differ from program to program. For example F1 key in most programs is to get help on that program.

Some important functions performed by some of the keys are:

- **Control keys:** These keys such as Control (CTRL), SHIFT, SPACEBAR, ALT, CAPS LOCK and TAB are used in combination with other keys to perform specific functions related to the operating system or software applications.
- **Enter key:** The Enter key, also known as the Return key, is a fundamental key on a computer keyboard. Its primary purpose is to execute a command or to move the cursor to the next line in a text document.
- **Punctuation keys:** Punctuation keys include keys for punctuation marks, such as colon (:), semicolon (;), question mark (?), single quotation marks (‘’), and double quotation marks (“”) are essential for proper grammar, syntax, and communication in written language.
- **Navigation keys:** These keys allow you to move the cursor or navigate through text and documents. They are essential for editing, selecting, and moving within different software applications. *Arrow Keys* (Up, Down, Left, Right) allow you to move the cursor or highlight text in the corresponding direction.

  The *Home key* moves the cursor to the beginning of a line of text or to the start of a document. The *End key* moves the cursor to the end of a line of text or to the end of a document. The *Page Up key* scrolls up one page at a time in a document or on a webpage. The *Page Down key* scrolls down one page at a time in a document or on a webpage.
- **Command keys:** Command Keys, such as INSERT (INS), DELETE (DEL), and BACKSPACE execute specific commands or functions within an application or the operating system. When the INSERT key is turned ON, it helps you overwrite characters to the right of the cursor. The DELETE key and the BACKSPACE key are used to remove typed text, characters and other objects on the right and left side of the cursor, respectively.
- **Windows key:** It is often denoted by the Windows logo ( ), and is found on most Windows-compatible keyboards. Pressing this key opens the Start menu.

Internet - Introduction

Nowadays, the Internet has become an important means of communication for the people even at remote locations. It is a worldwide system of interconnecting computers through a global network for the purpose of sharing information. It can be accessed by anybody all over the world.

It is defined as: "A global system of networks using wired or wireless mediums to interconnect different types of networks consisting of billions of computers, smartphones and other smart devices for sharing data and information with add-on features of entertainment, services and ecommerce."

If your computer is connected to the Internet, you say that your computer is online. With the help of the Internet, you can gather a lot of knowledge which is available on it. The knowledge is stored in a big library/ storehouse, called the World Wide Web (WWW) or the Web. It is a collection of different websites that you can view if you are connected to the Internet. You can also use these websites to buy something, watch movies, read books, learn new skills, educate yourself, find the best colleges to study further, etc. Uses of the Internet There is no limit to what you can do online, but some of the most common uses are given below:

- **Search information:** The Internet helps to locate information from the world wide web using search engines. These are websites that allow the users to search for any information using keywords or phrases. You can get the latest information about anything that is uploaded on the web, whether it is the result, news about an earthquake, a cricket match or the election details.
- **Shopping:** You can buy and sell products, such as books and electronic goods over the Internet. You can also pay for these products via digital modes of payments, such as wallets, plastic cardsor through e-banking.
- **Entertainment:** The online mode has become a new generation entertainment medium. You can watch movies/ series online, play games, listen to music, etc. There are online applications that allow you to even play musical instruments online. You can play games in teams with other people on this virtual platform.
- **Online booking:** You can book movie tickets, hotels, bus/train/ plane tickets, etc., online.
- **E-mail and chatting:** You can talk or send messages to people all around the world quickly and easily. The messages you send over the Internet can reach any part of world in just a few seconds. For example, Gmail and Outlook.
- **Online learning:** There are a number of courses available online-some are free while others are not. You can do a course on a topic you like or want to know more about.
- **Social networking:** You can share your interests, knowledge and stories with your family and friends around the world. For example, Facebook and Twitter.
- **Online banking:** You can do banking operations, like checking details of your bank account or transferring money from one account to another through mobile banking/NEFT/RTGS.

Connecting to the Internet

To connect to the Internet, you need:

- A device, such as a computer, laptop or mobile.
- A connection device, i.e., a modem. An Internet Service Provider (ISP)—i.e., the telephone company which provides the Internet connectivity using the phone lines or a wireless network.

Types of connections

- **Wired connections:** When our computer is connected to the Internet using a wire, it is called a wired connection. We use Ethernet cables (cables used for connecting to the Internet) to connect to the modem which connects to the ISP using a phone line.

- **Wireless connection:** You can also connect your computer to the Internet using wireless technology as shown in figure. Laptops need a wireless Internet card to connect to a modem with using any cables.

Desktop

Laptop

Modem

Modem

Wired connection

Wireless connection

Bandwidth

Bandwidth is the amount of data that can be transmitted over a network in a certain amount of time. To understand Let us take the example of a pipe, the amount of water flowing through a pipe depends on its thickness. Similarly, the amount of data that your network can receive or send depends on its bandwidth. In case of digital devices, the bandwidth is usually expressed in bits per second (bps) or bytes per second and in case of analog devices, the bandwidth is expressed in cycles per second, or Hertz (Hz).

Data transfer speed over the networks (including the internet) is calculated in terms of bits per second.

1 Kbps (kilo bits per second) = 1000 bits per second

1 Mbps (mega bits per second) = 1000 kilo bits per second

1 Gbps (giga bits per second) = 1000 mega bits per second

World Wide Web

The World Wide Web (WWW) or simply the Web is a huge collection of information. It is a vast network of linked hypertext files, stored on computers throughout the world, that can provide a computer user with information on a huge variety of subjects. Thus, it serves as a platform through which users can use or share information. It is made up of

- A web page
- A web browser
- A system to transfer information between the web browser and the web pages

Web page

A web page is a document present on a computer that is connected to the Internet. There are hundreds of web pages. Each web page has a unique address/location like the address of a house. We can use the address to see a particular web page. To view a web page you need a web browser on your computer.

Web browser

A web browser (commonly referred to as a browser) is a software application for using and sharing information on the World Wide Web. The most popular web browsers that are used today are

Chrome

Firefox

Opera

Safari

Microsoft Edge

Searching for information

Do the steps below to search for information on the Internet.

Step 1 Open an Internet browser.

Step 2 Type the topic, on which you want information, in the search box and hit the Enter key.

Step 3 The search results having the required information will be displayed.

Protocols

Protocols are a set of rules and standards that define how data is exchanged and transmitted over a network. They establish guidelines that enable devices and systems to communicate effectively with each other. Protocols govern various aspects of communication, including the format of data packets, error handling, authentication, and encryption.

Some of the important protocols are discussed below:

- **SMTP (Simple Mail Transfer Protocol):** SMTP is a protocol used for sending and receiving email. It handles the transmission of emails between servers and is responsible for the reliable and efficient delivery of emails over the Internet.
- **TCP/IP (Transmission Control Protocol/Internet Protocol):** TCP/IP is the foundational protocol suite of the Internet. It consists of two main protocols, TCP (Transmission Control Protocol) and IP (Internet Protocol). TCP ensures reliable delivery of data packets between devices on a network by establishing a connection-oriented session and managing packet sequencing and acknowledgment. It is a unique logical address of a device that helps identify a device at the time of sending and receiving data in a Network. It is made up of numbers or characters. Remembering these numeric values to access a specific website is a difficult task, so these numbers are given sensible textual names called web addresses.
- **FTP (File Transfer Protocol):** FTP is a standard network protocol used for transferring files between a client and a server on a computer network. It provides a simple way to upload and download files from one computer to another over the Internet.
- **HTTPS (HyperText Transfer Protocol Secure):** HTTPS is an extension of HTTP (HyperText Transfer Protocol) that adds a layer of security using SSL/TLS encryption. It ensures that data transmitted between a web browser and a web server remains private and integral. HTTPS is commonly used for secure communication over the Internet, particularly for sensitive transactions such as online banking, e-commerce, and accessing confidential information.

These protocols play critical roles in facilitating different types of communication and data transfer over the Internet, each addressing specific needs related to email transmission, network communication, file sharing, and secure web browsing.

Terminologies of the Internet

Some of the important terms related to the Internet are:

- **Online:** Going online means connecting your device to the Internet.
- **Hyperlink/HyperText/Link:** When a move pointer hovers over a word, text or graphics, it changes to a small hand and when clicked it opens a webpage or a website. It serves as a link for connecting many web documents to simplify the process of web browsing.

- **HTML (HyperText Markup Language):** HTML is the standard markup language for creating web pages. It structures content using tags and elements, defining the layout and appearance of web pages in conjunction with CSS and JavaScript.
- **Website:** Collection of related web pages that can be accessed by a unique web address or URL. A website is owned either by an individual or any organisation and can be hosted on a World Wide Web.
- **Homepage:** The first page displayed when you visit a website is called a homepage. It generally contains the hyperlinks for the other webpages.
- **ISP (Internet Service Provider):** An ISP is a company that provides individuals and organisations access to the internet. ISPs offer various services such as internet access, domain registration, web hosting, and email services.
- **Web address/URL (Uniform Resource Locator):** It is the address of the web file located on a web server that can be accessed using any web browser on the Internet. It is similar to the address we write on an envelope. URL is translated into a numeric address using the domain name system. For example: https://www.orangeeducation.in/
- **Cookies:** Cookies are small pieces of data stored on a user's device by websites they visit. They are used to remember information about the user, such as login status, preferences, and tracking information for personalised experiences and analytics.
- **DNS (Domain Name System):** It is a phonebook of the Internet that translates each URL into its corresponding IP address. Each device connected to the Internet has a unique IP address. Since it is difficult to memorise IP addresses, so for convenience the alphanumeric address is used for naming the websites. When we type the alphanumeric address in the address bar of the web browser, then, the DNS translates it into an IP address and requests the web server to locate the specified file on its site.

Some common Top-Level Domains are as follows:

Abbreviations	Used to Denote	Abbreviations	Used to Denote
.com	Commercial firms	.net	ISP's/Networks
.edu	Universities/Educational firms	.org	Non-Government/Non-Profit Organisations
.gov	Government Bodies/Organisations	.co	National and Multinational Companies
.mil	Military Organisations	.int	International Organisations

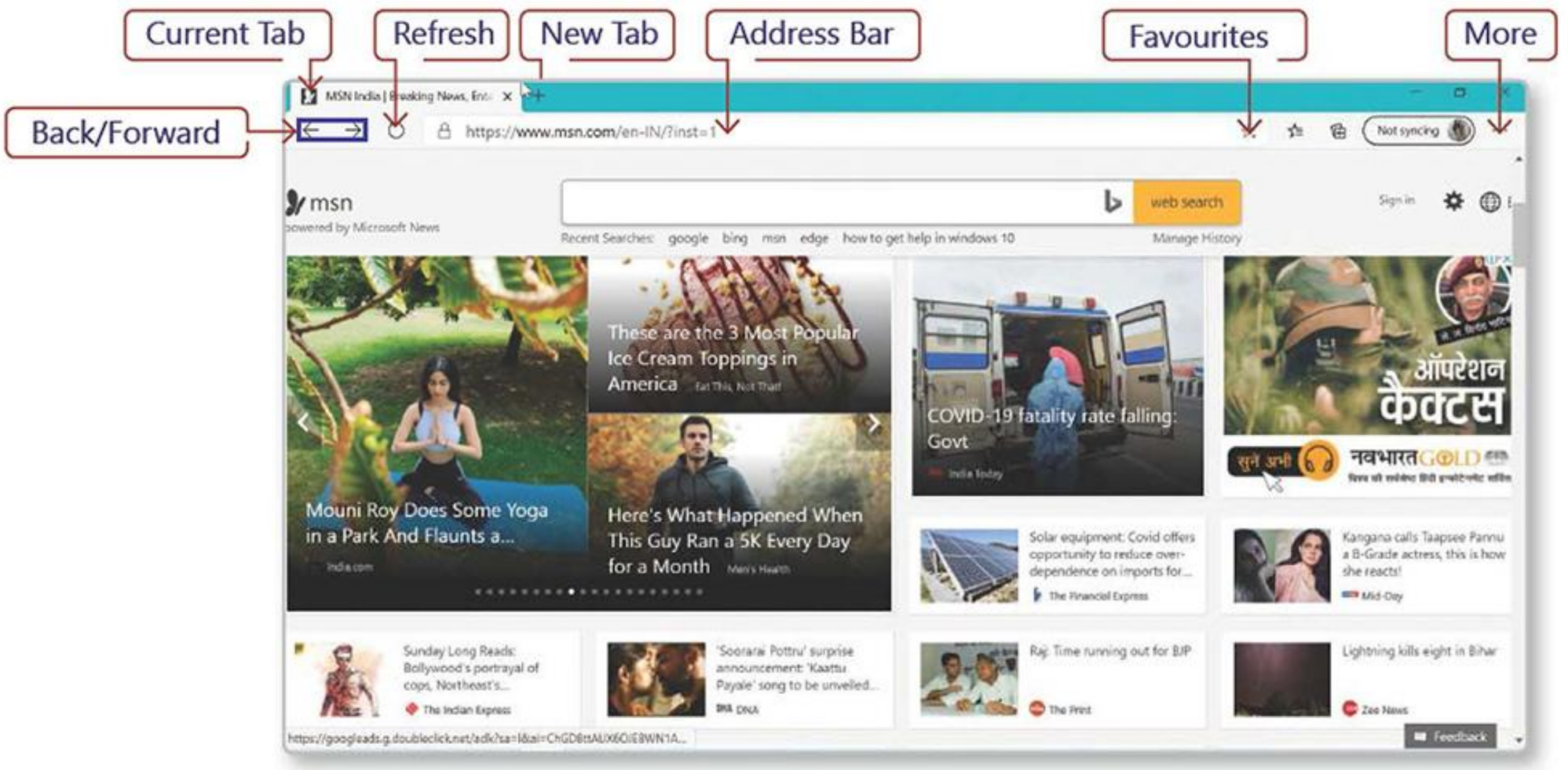
In DNS, codes of countries can also be included. The code comprises of two letters. Some common codes of certain countries are:

Code	Denotes the Country	Code	Denotes the Country
.au	Australia	.in	India
.uk	United Kingdom	.us	United States of America
.jp	Japan	.nz	New Zealand
.fr	France		

- **Firewall:** A firewall is a network security system that monitors and controls incoming and outgoing network traffic based on predetermined security rules. It acts as a barrier between a trusted internal network and untrusted external networks, like the internet.
- **IP (Internet Protocol) Address:** It is a unique logical address of a device that helps identify a device at the time of sending and receiving data in a Network. It is made up of numbers or characters. Remembering these numeric values to access a specific website is a difficult task, so these numbers are given sensible textual names called web addresses.

Microsoft Edge

Microsoft Edge is designed by Microsoft and comes as a default browser installed with Windows Operating System. To make your navigation easier on the Internet, we have to understand some basic features of Microsoft Edge.



Some of its commonly used options are explained below:

- **Title Bar:** The bar on the top of the Microsoft Edge window that displays the name of the application and website.
- **Control Buttons:** These are present on the right corner of the Microsoft Edge window. Maximise, Minimise, Restore and Close buttons are the Control Buttons to handle the application program in different ways.
- **Address Bar:** The wide bar just below the title bar is the address bar. This bar is used to enter the web page address you wish to visit. Press the Return or Enter key to access the site or click on the "Go" or arrow button to the right of the address box.
- **Search Bar:** The search bar next to the address bar can be used to type these keywords or phrases. The browser will check these in all possible websites and will display the list of hyperlinks and websites in the browser.
- **Navigation Bar:** These buttons help move back and forth through web pages you have visited. Some of the commonly used buttons are:
  * Back, Forward, Home, Refresh, Reload, Stop.

Reboot

1. Explain any two types of protocols.

2. What is the use of a web browser?

3. What are the differences between a web client and a web server?

4. Write any two applications of Internet.

Email

Electronic mail is the most popular and convenient way of sending and receiving messages through the Internet. It takes no time to deliver a message in the inbox of any email service provider like Gmail, Yahoo, Outlook, Hotmail, etc. Nowadays, it has become a cheap and an effective way to keep in touch with your family and friends. In an organisation, there is no need to maintain the log of the official letter sent to different employees working at different hierarchies manually.

Differences Between Postal Mail and Email

Following are some differences between postal mail and email:

- Postal mail is the traditional way of sending physical mail which takes a few days to deliver. Email is the fastest way to send digital messages all across the world within a fraction of seconds.
- Postal mail is chargeable and the cost increases with the distance and the weight. If you are planning to send some magazines, brochures, photo album, then, the cost will increase. In Email, we pay only for the Internet with no extra cost of the email services. So, it is the cheapest way to send mail with bulky content. You can send photos, audios, videos, animation, documents, etc. as an attachment easily.
- In postal mail, if you have to send the same letter to multiple recipients, then, it is an expensive process. Through email we can send the same mail to multiple recipients by just writing the email address in cc or bcc with no added cost.
- In postal mail, the recipient can receive a mail only at the marked geographical location using street number, locality, city, pincode, etc. In email, it is a logical address that can be accessed from any computer and at any location all over the world.

Advantages of Email

The following are the advantages of using email:

- Sending and receiving emails is a fast way of communicating as compared to the traditional mails.
- Emails can be sent anytime. That means it's not restricted to only working days or working hours.

- Emails can be sent to one or multiple recipients without much effort and at no cost.
- It is an inexpensive way of mailing as it only requires an Internet connection.

Components of Email Address

An email address is a unique logical address of an email account in any email service provider. A user can send and receive messages using an email address. It is made up of:

- **Username:** It is a unique name which is not case sensitive and spaces are not allowed.
- **@sign:** It works as a separator of the username and domain name in an email address.
- **Domain name:** It is the name of the email service provider. For example— gmail, yahoo, hotmail, etc.

  For example: orangebooks@gmail.com

  authors_orange@hotmail.com

  anjana.shalini@outlook.com

  myaccount@orangeeducation.in

Structure of an Email Message

Following are the major sections of an email message:

- **Header:** This section allows you to enter the following information:
  * **From:** Email address of the sender.
  * **To:** email address of the recipient.
  * **Cc (Carbon Copy):** This option is generally used when we want the same message to be sent to a large group of people at the same time. The list of all the recipients will be displayed in the received message header. We can also use this option when we want another person to be informed of the mail sent to the recipient.
  * **Bcc (Blind Carbon Copy):** This Email address is invisible to a recipient. This option is used when you want to send a copy of an email to another person without bringing it to the knowledge of the recipient. It will not be displayed in the received message header.
  * **Subject:** It is the brief discussion of the topic of the message.
- **Body:** The main content of the email, written by the sender, is in the body. It consists of the message and the signature of the sender.
- **Attachments:** We can attach any type of file like word document, presentation, any program code, audio, video etc. It is usually a symbol of a paper pin. Select this option to open a dialog box which gives access to files stored in your device. Select a proper path to attach the required file.
- **Date:** It is the date and time of sending a message.

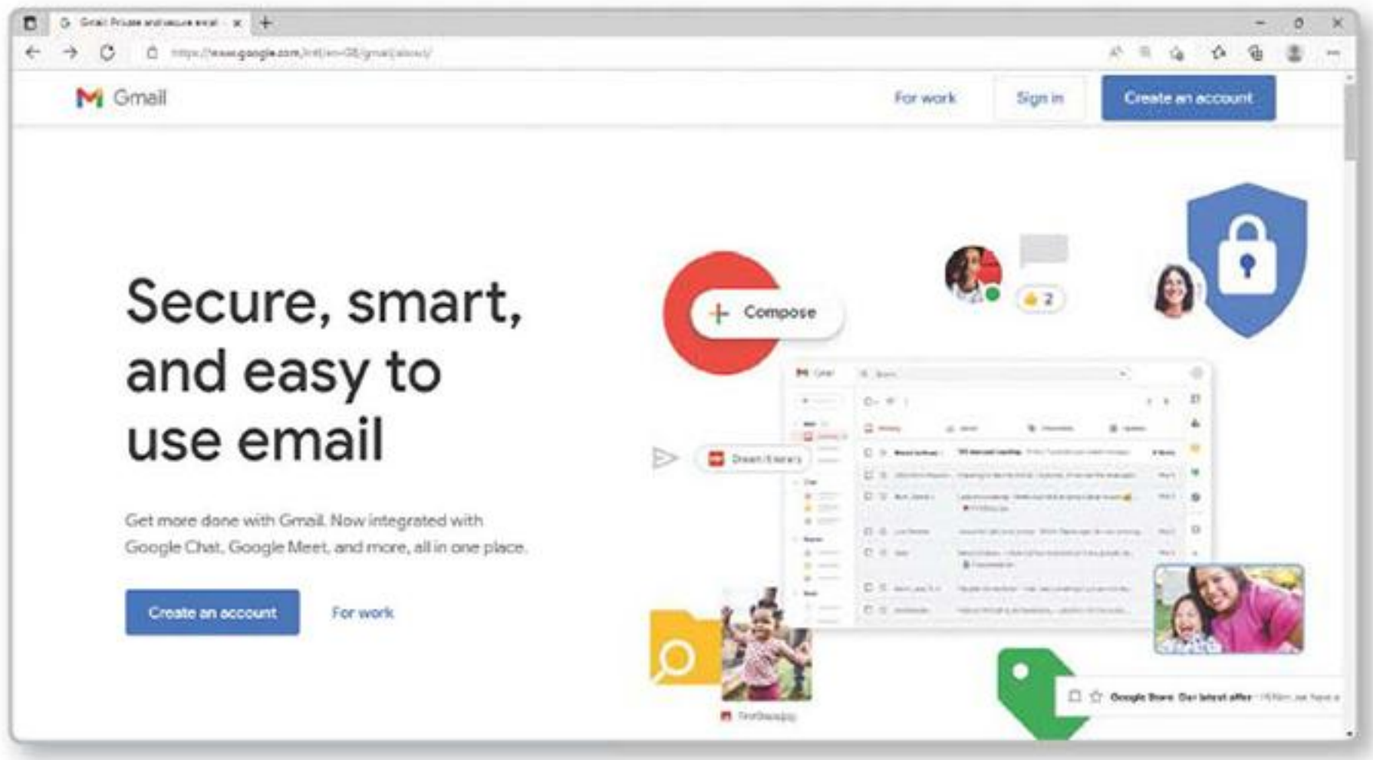
Brainy Fact

The first email was sent in 1971. Ray Tomlinson, the engineer who invented the email program on the ARPANET system.

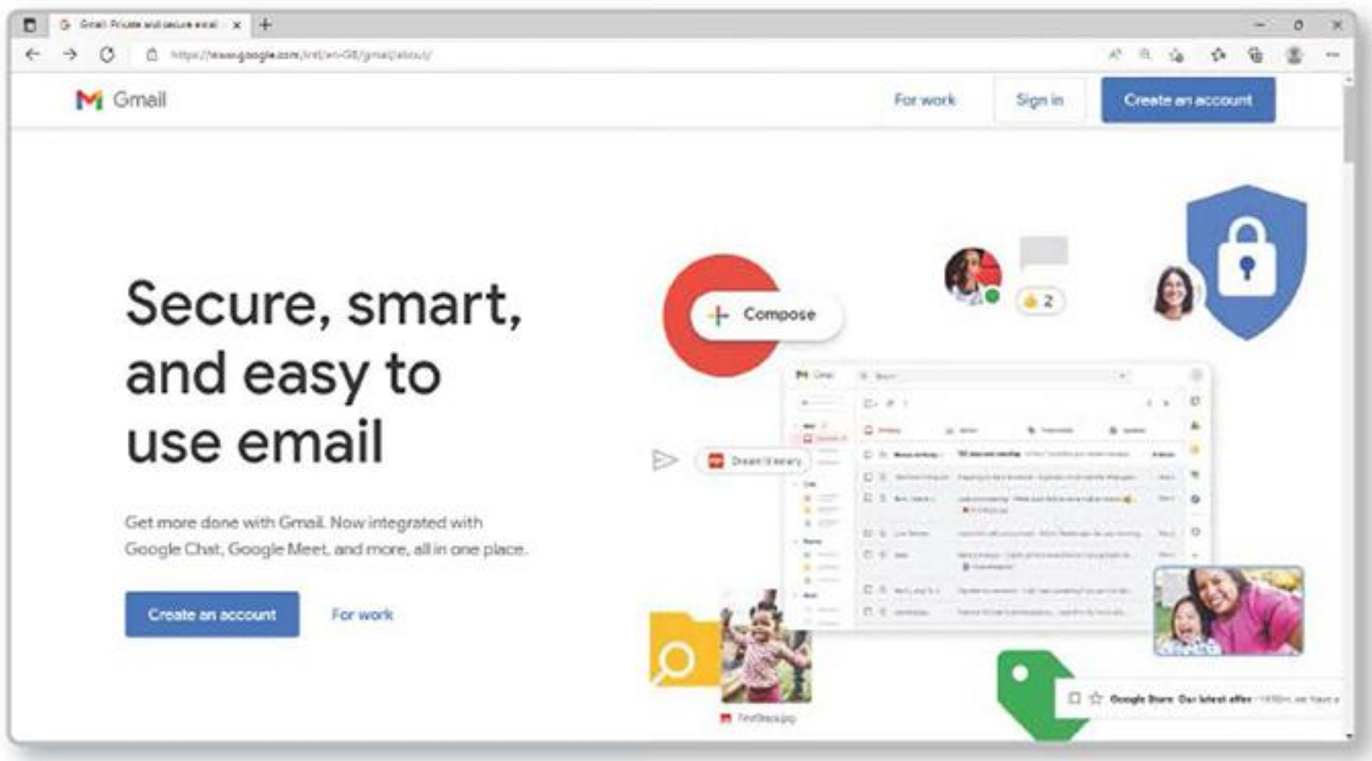
Creating an Email Account

Before we get into this process of sending and receiving an email, it is important to create an email account. Either we can have a paid email service by creating an email using an ISP server or we can create an email account by using a free web based email service provider. Some of the commonly used are: Hotmail.com, Gmail.com, Outlook.com, Yahoo.com, rediffmail.com etc. You can write the email address of any of these in the address bar of any browser window. Let us now proceed to create an email account in the Gmail email service:

Step 1 Connect your computer to the Internet and type www.gmail.com in the address bar browser window. It will display the following screen:

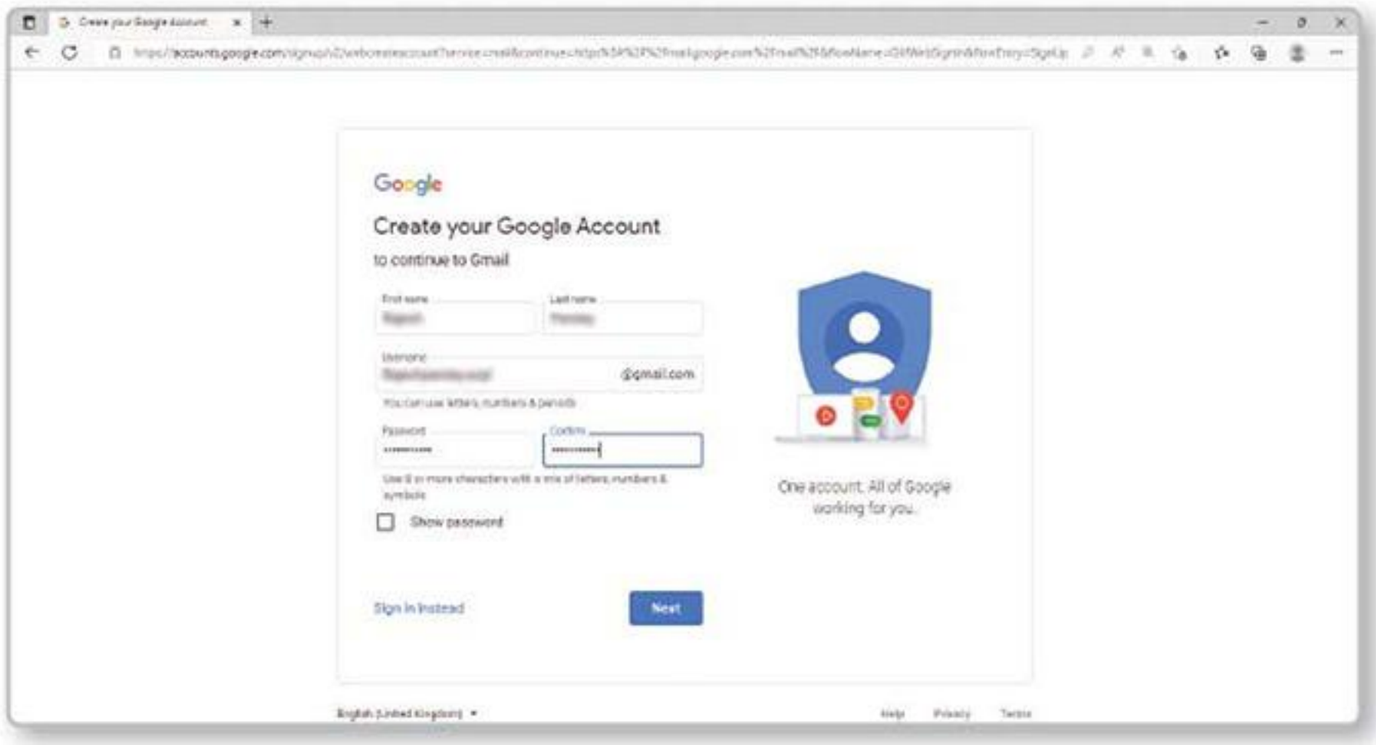


Step 2 Click on Create account option.

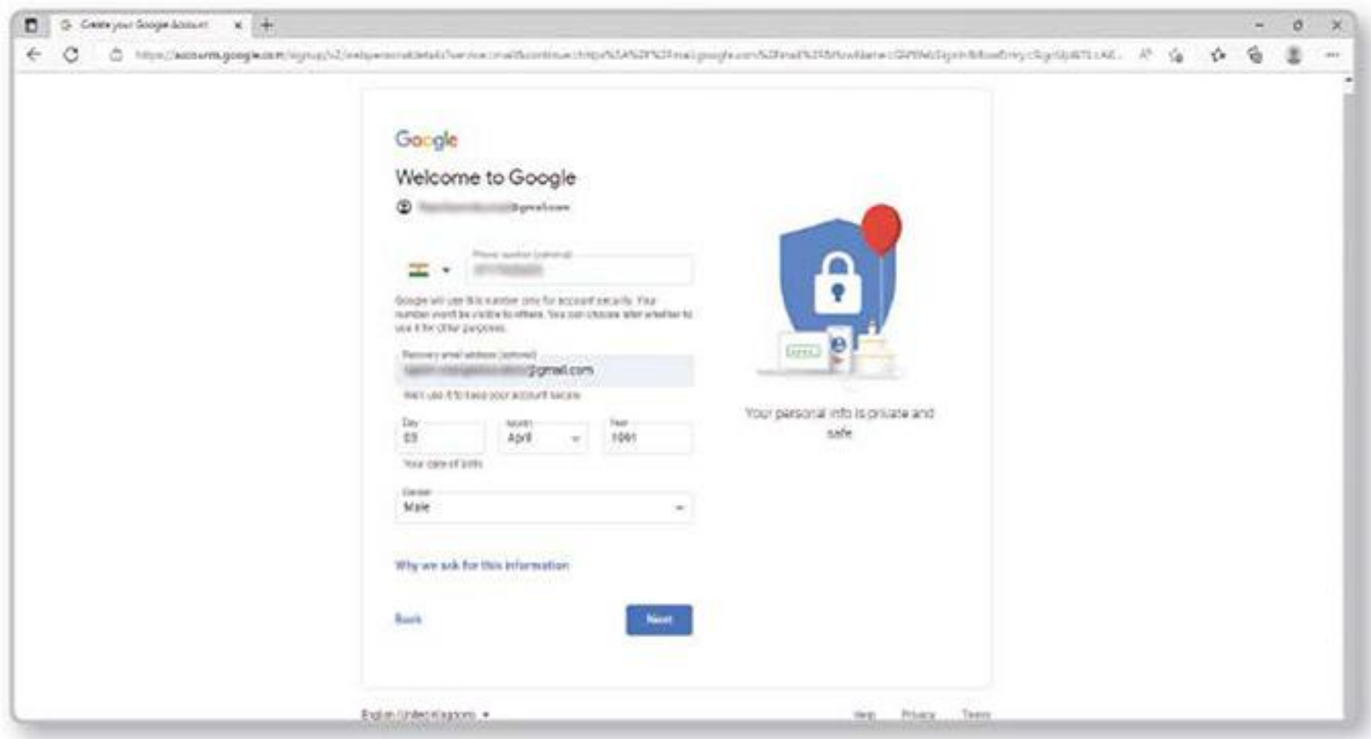


Step 3 A window will open which will ask for the **new username** and **password.** It is always advisable to choose a strong password so that it is difficult for others to have access to your account. At the time of assigning a username, you may get a message "this user already exists" as there are so many users.

This is to take care that only unique email ids are created. So, keep trying different combinations to create a unique username. After this is done, click on **"Next"** button.



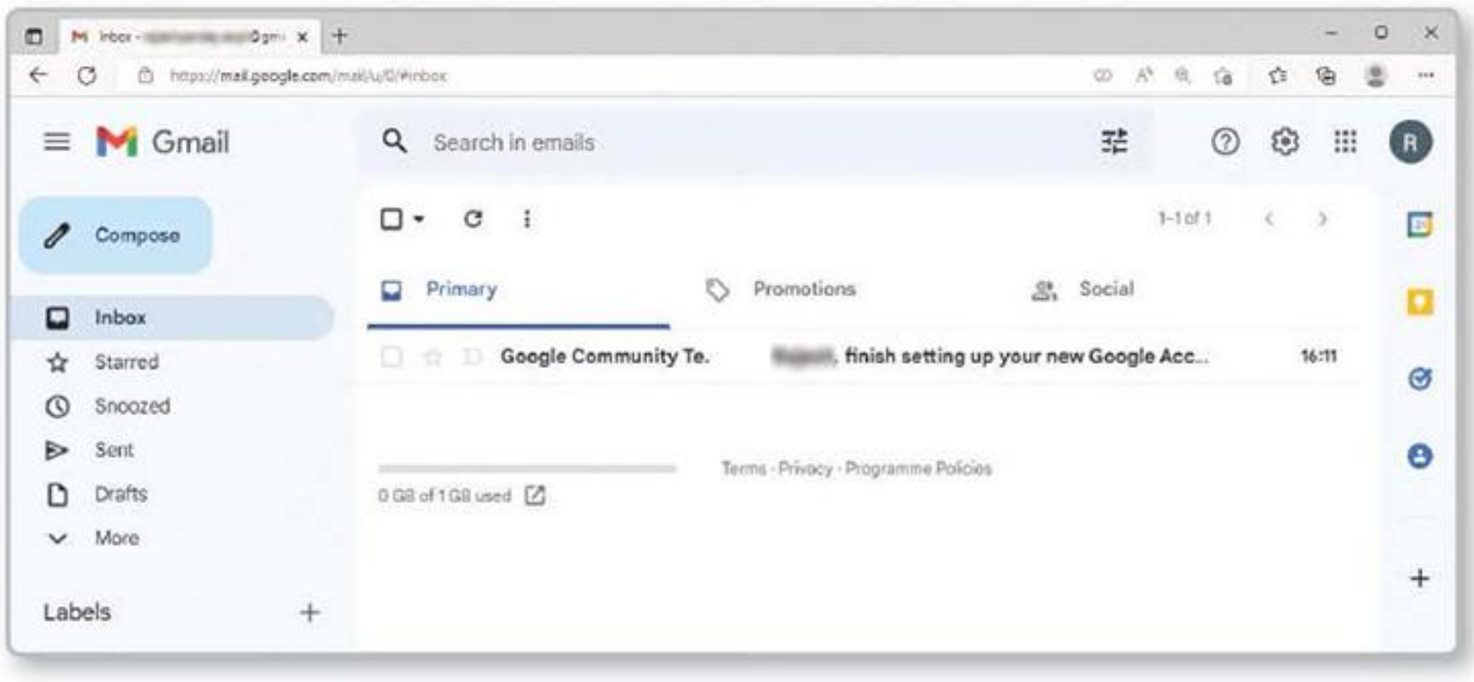
Step 4 A window will be displayed which will ask for some additional data like date of birth, alternate email address, email recovery questions etc. After you specify these details, click on **"Next"** button.



Step 5 When you click on the Next button, Google will send a verification code on your mobile number that you have entered in the previous steps.

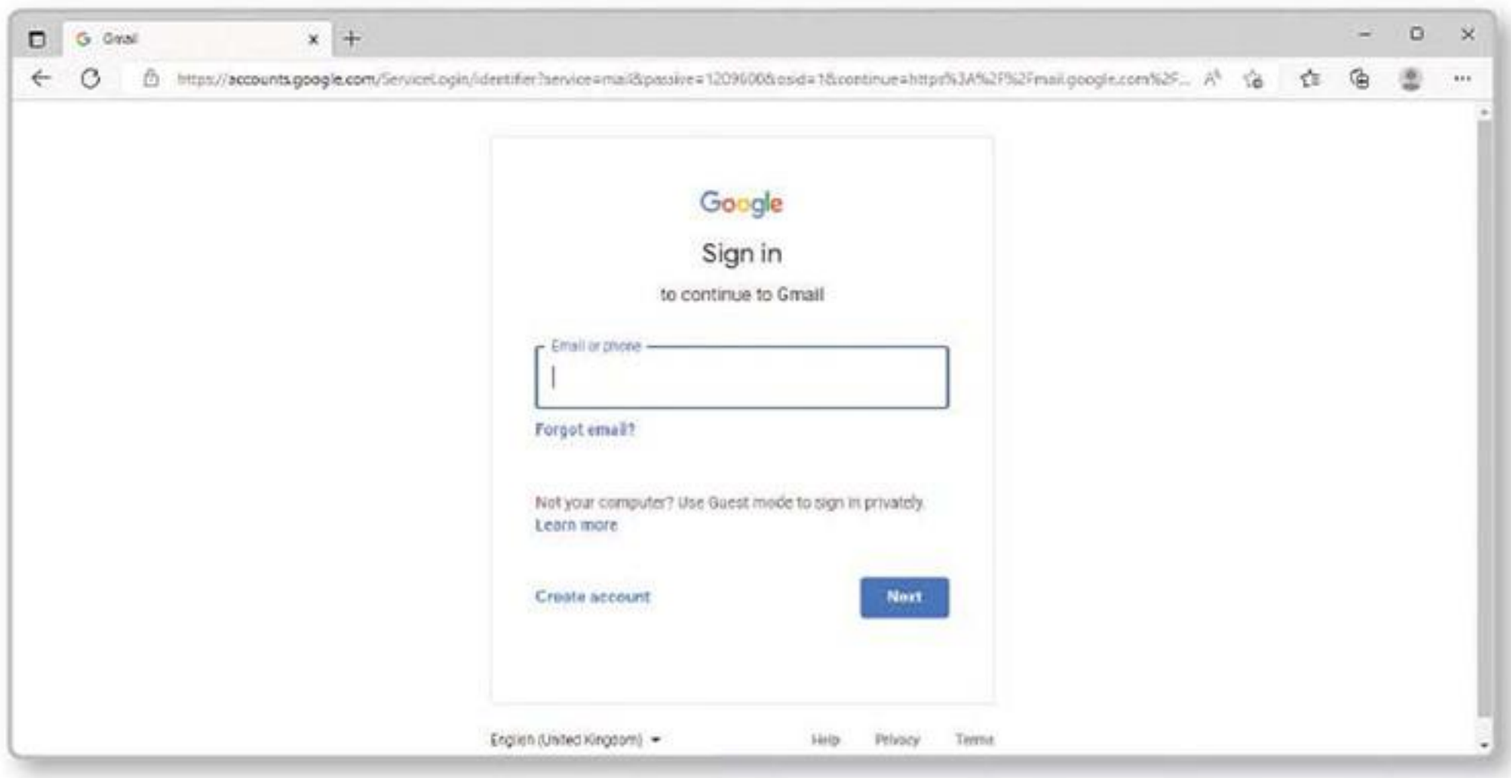
The next screens ask to enter the verification code. After entering the code, when you click on the Verify button, a window will be displayed with details of the "Privacy Policy". Select "I agree" option and then click on "Next" button.

Step 6 After this, an account is created and a homepage of the newly created Gmail account will be displayed as shown below:



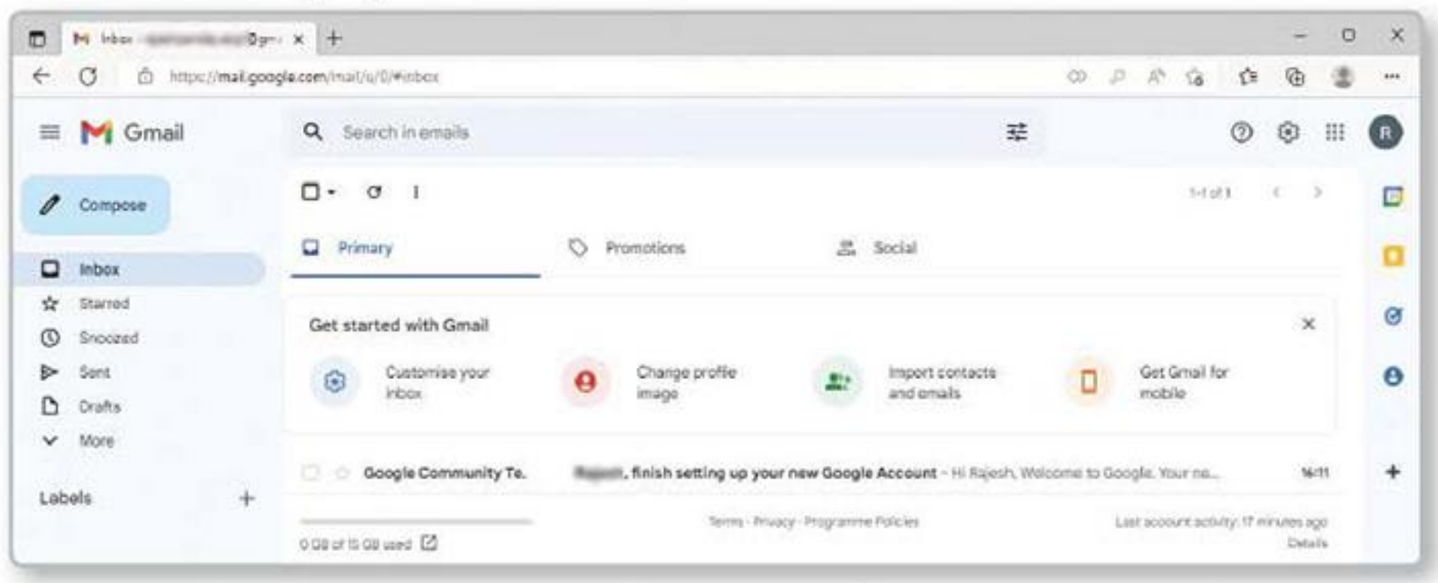
Composing an Email

Composing an email means drafting a mail and sending it to the concerned recipient. Let us follow the given steps to design a new email:



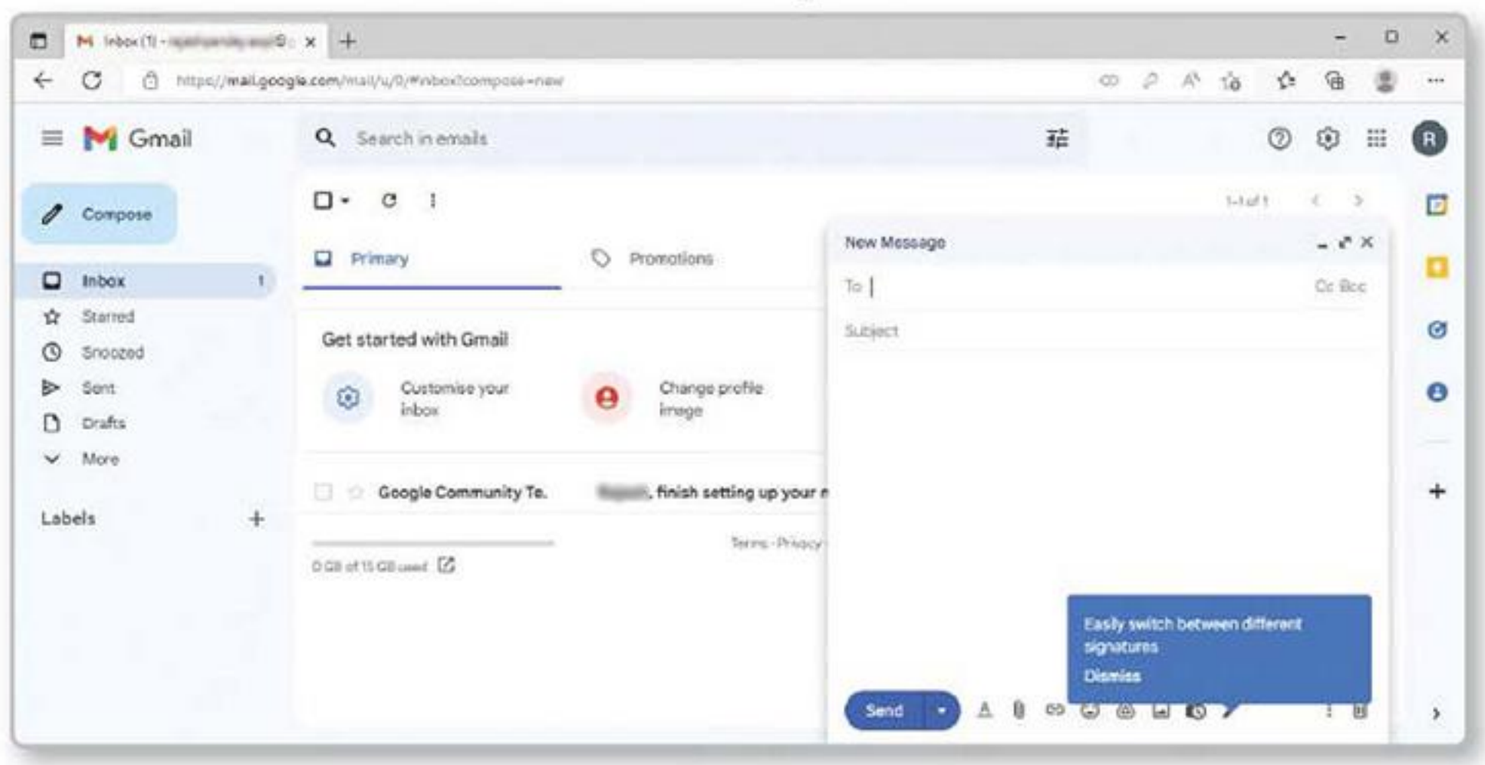
Step 1 Connect your computer to the Internet and type www.gmail.com in the address bar of any browser window. It will display the following screen.

Step 2 Enter your username and password to login. Click on "Next" button. The homepage screen of your email account will be displayed.



Step 3 Click on "Compose" to create a new email message. The given screen will appear.

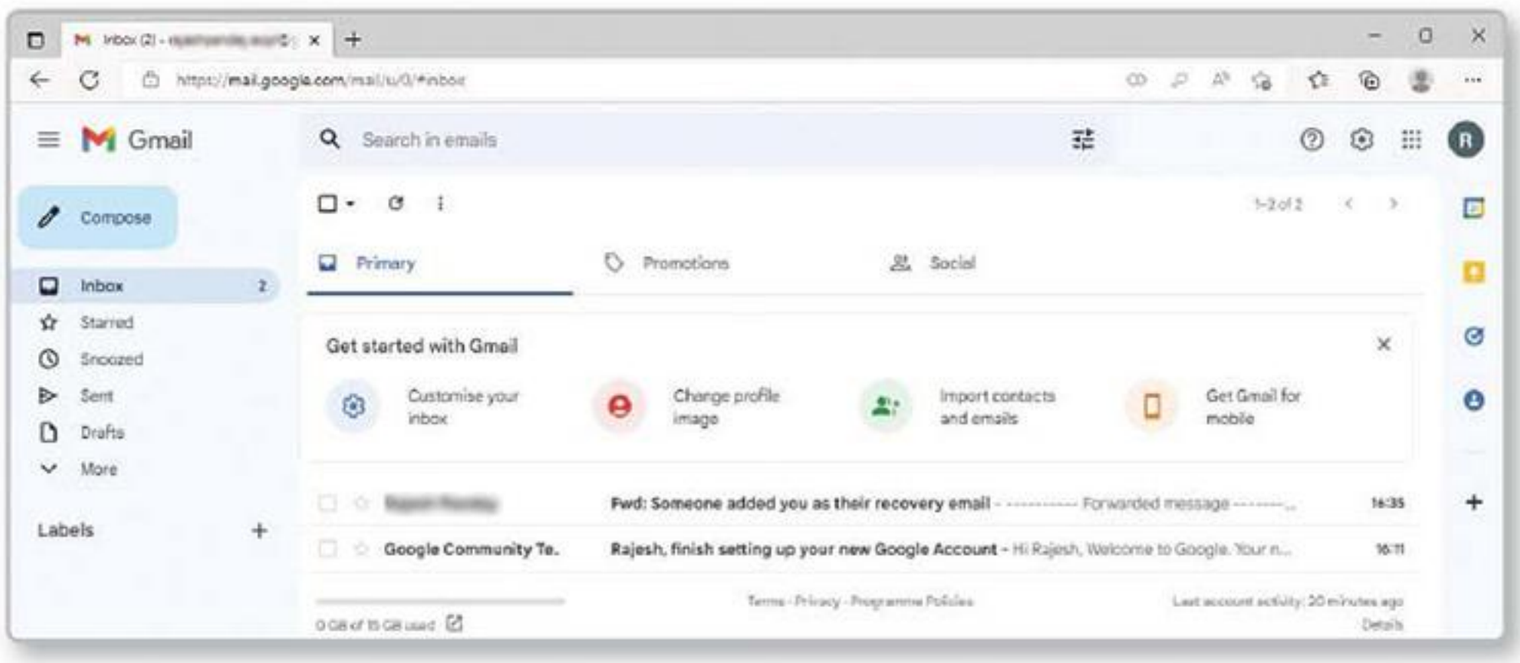
Step 4 Compose the email message using the above structure. You can do the formatting of the message using the basic formatting toolbar available. Attach a file if required and click on "Send". The message will be sent and delivered in the inbox of the recipients.



Receiving and Reading the Mails in the Inbox

When someone sends you a message, it will appear in your Inbox folder. Following are the steps to receive and read the mails in the inbox:

Step 1 Login with your user name and password. The homepage screen of your email account will be displayed.



Step 2 Click on **Inbox** to see the list of mails present in the mailbox.

Step 3 Click on any mail you wish to read. It will open with the mail header and the content.

Replying and Forwarding an Email

Occasionally, you will need to reply to the sender or send the original message to another person/group. Following are the steps to reply and forward an email:

Step 1 When you receive an email and you wish to send a reply to the same person, then, select the "Reply" button. A compose window with the name of the recipient will be automatically filled in the Header— "To".

Step 2 Add up the content and click "Send".

Step 3 In case you wish to forward the same mail to somebody else, then, click on "Forward". The content will be copied with the cursor blinking in Header— "To" so that you can write the email address of the recipient— to whom you wish to forward the mail.

Deleting an e-mail

You can delete the mail by clicking on the delete icon. This will remove the e-mail from your inbox and move it to the "Trash" folder. It will remain there for a few days before it is removed from the system.

Common Folders in Mailbox

Some of the common folders of mailbox are:

- **Inbox:** It contains the list of mails received in a mailbox. The unread mails are in bold. Most recent mails are arranged on the top of the list. It provides us with different options to rearrange the mails in different order.
- **Sent:** It contains the list of the mails sent. The most recently sent mails will be arranged on the top of the list.
- **Draft:** It contains the list of the mails created but not sent. Sometimes, we write an incomplete mail and wish to send it later, then, we can save it as a draft. Later, when we send it, then, it automatically gets removed from the draft.
- **Spam:** Spam refers to junk, unwanted, unsolicited mail sent to a large group of people for the purpose of advertising their commercial, non-commercial or prohibited products. It is a way of marketing through the Internet where millions of users are getting the same mail. A person who creates spam is called a spammer. Email service automatically keeps spam mails in a spam folder of the mailbox.

- **Trash:** An email deleted by the user will be stored in the trash folder for a specified time. Also, a user has a choice of recovering it back in case needed.

Introduction to Social Media

Social media is sharing ideas and information in a community using Internet as a digital platform. Social networking is the process of creating and maintaining a virtual community with the like— minded people or a group. It is an Internet based media that provides facility to connect to family, friends, clients, customers, followers etc. Let us learn about some of the social media websites.

Blogs

A website owned by a person or an organisation and containing posts in the form of a discussion or informal conversation is called a Blog. The post appears in a reverse chronological order where the most recent is on the top. It is an online journal where people can post their views based on a specific subject like sports, politics, education, entertainment, music, celebrities, cricket, news etc.

Blogger

A typical blog contains text, images, audio, video, animation, links etc related to the subject. A blogger is a person who runs and updates a blog. Now-a-days, most of the celebrities run their own blogs to increase their fan-following. Some popular free blog publishing platforms are www.blogger.com, www.wix.com, www.wordpress.org, etc.

X

X

It is an American social networking service where the registered users can post and read short messages (tweets). The message may contain text, videos, animations, audios, images, etc. It is a very popular social media platform available these days. People connect by following other people's tweets. X Chats can be used to discuss any topic with like-minded strangers. Most of the times many celebrities, athletes and politicians choose to post on X directly rather than speaking through media outlets when they want to share information related to their profession or their personal life with their fans.

Facebook

It is one of the largest online social networking websites. Originally designed for college students, Facebook was created in 2004 by Mark Zuckerberg while he was enrolled at Harvard University. It is a website, which allows logged-in users to connect with friends and family members across the globe. It allows the users to share their thoughts, locations, pictures, music, videos, etc. with their friends. It provides brand exposure to many potential users and has become a new way of marketing by entrepreneurs.

Facebook

YouTube

YouTube

YouTube is a simple video sharing platform that allows users to like, share, download, upload videos, etc. The videos can be accessed on computers and mobiles using the Internet. These videos can be easily shared on any social media. Now-a-days, making videos and uploading on YouTube is a new trend. You can find videos for anything and everything. These videos can also be embedded directly in any software/application. It is also one of the ways to store videos online by sharing it with others.

Brainy Fact

The very first video on YouTube was launched at 8:27 pm on Saturday, 23rd April,2005.

WhatsApp Messenger

It is a freeware owned by Facebook that allows the users to share messages, documents, multimedia data, location, etc. This application is a combination of both messaging and Voice over IP. It uses your phone/computer's Internet connection to connect to anyone through messages or calls. It also provides facilities for group messages or group calls. It's a convenient way of communicating in small groups like families/office staff/organisations.

WhatsApp

Digital India

It is a campaign launched by the Government of India to make our country digitally equipped. Prime Minister Narendra Modi launched the campaign on 1st July 2015. Under this scheme all the government services are now available electronically for better and faster execution of services to Indian citizens. Digital India has immensely improved the online infrastructure of our country. The country now has better Internet connectivity and progressed in the field of Information Technology.

Digital India

The main objectives of this initiative are:

- To provide a high speed network in the rural areas.
- To provide governance and services on demand.
- Digital empowerment of every citizen of India.
- Restructuring many existing schemes under Digital India Program so that they can be implemented in a synchronized manner.

At a Glance

- Information Technology is the use of hardware, software and networking technology for accessing, storing, retrieving and transmitting the information.
- Communication Technology is defined as exchange of information through networks using either wired or wireless media.
- All physical components of the ICT system which we can touch and feel are called hardware.
- A computer is an electronic device that takes an input from the user and processes it in a desired way and generates an output in a specific format.
- A set of instructions that we give to a computer to get the work done is called software.
- The devices which help to give data or instructions to the computer are called input devices.
- An output device is a physical component that converts the processed data or information into a human readable format.

- The measuring unit to measure our data stored in memory or storage devices is byte.
- Peripheral device ports act as a connector or a point of attachment between the external peripheral devices like mouse, printer, keyboard, camera, scanner, etc. and the computer.
- Motherboard or the main board consists of a board containing electric circuits that connects all the important components of the computer.
- An operating system is the manager of the computer which comes into role as soon as the power is switched on and it remains there in the computer memory till we shut down the computer.
- The standardised sets of rules that govern the transmission of data and information efficiently between different computers connected in an Internet are called protocols.
- A web browser is an application software designed to access web information through hyperlinks, web pages and websites.
- Electronic mail is the most popular and convenient way of sending and receiving messages through the Internet.
- Social networking is the process of creating and maintaining a virtual community with the like-minded people or a group.
- Digital India is a campaign launched by the Government of India to make our country digitally equipped.

Exercise

Solved Questions

SECTION A (Objective Type Questions)

Quiz

A. Tick (✓) the correct option.

1. Which of the following is the full form of the ICT?
   a. Indian Communication Technology ○ b. Information and Communication Technology ○
   c. Internet and Communication Terminology ○ d. Industrial Computer Technology ○
2. Which of the following is not true for the use of ICT in education?
   a. Smart Boards ○ b. Smart pens ○
   c. Driverless cars ○ d. Virtual classrooms ○
3. What is the collection of 8 bits called as?
   a. KB ○ b. Byte ○
   c. GB ○ d. Bits ○
4. Which of the following is not an input/output device?
   a. Mouse ○ b. Scanner ○
   c. Network ○ d. Speaker ○
5. It stores and provides quick access to large amounts of data on an electromagnetically charged surface or set of surfaces.
   a. CD ○ b. DVD ○
   c. Pen-Drive ○ d. Hard Disk ○
6. Which of the following is a set of few program icons made available on the taskbar for its immediate access?
   a. Taskbar ○ b. Quick Launch Program Icons ○
   c. Start Menu ○ d. Status Bar ○

7. Which area in earlier versions of Windows was known as System Tray?

a. Task bar ◯ b. Start Menu ◯

c. Desktop ◯ d. Notification ◯

8. The shortcut key to display the desktop when you are working in multiple windows is .....

a. Windows Key + A ◯ b. Windows Key + M ◯

c. Ctrl + D ◯ d. Windows Key + D ◯

9. Which of the following is a collection of related web pages that can be accessed by a unique web address or URL?

a. Web server ◯ b. Homepage ◯

c. website ◯ d. Web address ◯

10. What does GPS stand for? [NCERT]

a. Global Positioning System ◯ b. Global Payment System ◯

c. Global Program System ◯ d. Global Pointing System ◯

B. Fill in the blanks.

1. ..... is defined as exchange of information through networks using either wired or wireless media.
2. ..... means the buying and selling of products through an online medium.
3. ..... is the processed data.
4. A person who creates spam is called a ..... .
5. ..... are a combination of a laptop and a smartphone.
6. The main content of the email, written by the sender, is in the ..... .
7. ..... is a freeware owned by Facebook that allows the users to share messages, documents, multimedia data, location, etc.
8. ..... refers to junk, unwanted, unsolicited mail sent to a large group of people for the purpose of advertising their commercial, non-commercial or prohibited products.
9. A ..... is an application software designed to access web information through hyperlinks, web pages and websites.
10. The option of ..... is generally used when we want the same message to be sent to a large group of people at the same time.

C. State whether these statements are true or false.

1. ICT helps us to pay our utility bills online. .....
2. Information is given as Input in ICT System. .....
3. Unprocessed data is called Information. .....
4. The physical components of the computer which we can touch and feel are the hardware. .....
5. Input is also called meaningful data or Information. .....
6. The flow of information follows a cycle which is known as the Input-Process-Output Cycle. .....
7. Storage methods are used to convert raw data into meaningful information. .....
8. Folder is defined as a program that stores the data organized in a specific format. .....
9. When we switch on the power button of a computer, then, the system boots and displays the first screen popularly known as Desktop. .....
10. DOS supports multiuser and multitasking. .....

SECTION B (Subjective Type Questions)

A. Short answer type questions:

1. What is the impact of ICT in our personal life?

Ans. ICT has impacted our lives in the following ways: Shopping, Communication, Entertainment, Education, Healthcare, Socialising, Source of information.

2. List two impacts of ICT in entertainment.

Ans. Impacts of ICT in entertainment are:

- Online shows and series.
- Availability of satellite television.

3. What is the difference between data and information?

Ans.
- **Data:** It is the collection of raw facts or figures in the form of text, numbers, graphs etc. Also called raw data or unprocessed data. Provided to the computer using Input devices like keyboard, mouse, scanner etc.
- **Information:** It is the processed data which has been manipulated and arranged in the form the user wants. It is also called meaningful data or Information. Given to the user through output devices like monitor, Printer, Plotter, Speaker etc.

4. What is a use of a scanner?

Ans. Scanner is a device that is used to read the hand written notes, images, and photos and transfer them in a digital form onto the computer which can later be saved or manipulated as per the requirement.

5. What does the Notification Area contain?

Ans. It displays the system notifications and the status of the other tasks running in the background. It has Speaker, Power, Network Connection, Antivirus program, Windows update notification.

6. What are Quick Launch Program Icons? How can you add or remove programs in this set?

Ans. There is a set of few program icons made available in the taskbar for its immediate access without getting into the hassle of going through different menus and sub-menus. It also displays small pop-up rectangle windows of the already opened programs.

We can add and remove programs in this taskbar by selecting the program from start menu. You can either drag or drop on the taskbar or right click on the program and select "Pin to Taskbar"

7. What is the purpose of double-click of a mouse.

Ans. When we use the left button click twice in quick succession, then, it is called a double click. We generally use double click to open a file/folder, to open a specific program or application software.

8. Define the Internet.

Ans. A global system of networks using wired or wireless mediums to interconnect different types of networks consisting of billions of computers, smartphones and other smart devices for sharing data and information with add-on features of entertainment, services and ecommerce.

9. What is WWW made up of ?

Ans. WWW (World Wide Web) is made up of a web page, a web browser and a system to transfer information between the web browser and the web pages.

10. Name any 3 commonly used buttons in a Navigation bar.

Ans. Back, Forward and Home

11. Name "Trash" folder in mailbox.

Ans. An email deleted by the user will be stored for a specified time in this trash folder. A user has a choice of recovering it back also in case needed.

12. What are the key skills one should possess to use ICT? [NCERT]

Ans. Basic ICT skills that one should possess to use ICT are:

- knowing how to operate computers
- knowing how to use Internet to browse for collecting, storing and disseminating information.

B. Long answer type questions:

1. Discuss any three impacts of ICT in personal life.

Ans. Impacts of ICT in our personal life are:

- **Shopping:** Our shopping habits have changed because of the online medium. Instead of going to market, we can receive everything at our doorstep with online shopping. It not only saves our effort of going out but also provides us with options of reasonable prices.
- **Communication:** ICT helps us to communicate to our friends and relatives. There are more and more ways to talk to people without meeting them. For example through email, video conferencing, video calls, etc.
- **Entertainment:** Till now television was the only way of home entertainment. The trend has changed tremendously. Nowadays there's a parallel entertainment industry that is producing entertainment programs for online mediums. There are series and movies that are launched online only.

2. Define any two ICT tools.

Ans. Following are the tools of ICT:

- **Smartphones** are considered important ICT tools due to their multifunctionality and portability. It enables the users to seamlessly integrate work, communication, and entertainment that enhances accessibility and connectivity.
- **Tablet** is a mini computer with input, output and processing functions that are all combined into one 'touchscreen', where you can do various tasks just by touching its screen. It is bigger than a smartphone and you can perform all the functions that one can perform on a computer or a smartphone.

3. What are the four basic operations of computers?

Ans. Computer performs four basic operations:

- **Input (Raw Data):** It is the collection of raw facts or figures in the form of text, numbers, graphs, etc. Also called raw data or unprocessed data. Provided to the computer using Input devices like keyboard, mouse, scanner etc.
- **Process:** It is the methods used to convert raw data into meaningful information. The Central Processing Unit (CPU) of the computer is responsible for processing of data.
- **Output (Information):** It is the processed data which has been manipulated and arranged in the form the user wants. It is also called meaningful data or Information. Given to the user through output devices like monitor, Printer, Plotter, Speaker etc.
- **Storage:** It is storing either raw data or processed information. Stored either using secondary storage devices like Flash drive, Hard disk, Compact Disk or online storage medium like Google cloud, etc.

4. Explain the different parts of the CPU.

Ans. CPU is basically divided into three parts:

- ALU stands for Arithmetic Logic Unit. It is responsible for all mathematical and logical calculations.
- CU stands for Control Unit. It controls the flow of information in the system. The control unit is responsible for the flow of data from input devices to the process unit and then to the output devices. It works like a traffic policeman who controls the traffic on the road.
- MU stands for Memory Unit. It is a storage unit that holds the processed or unprocessed data.

5. Define OS. Give examples of operating systems.

Ans. An operating system is system software which acts as an interface between the user and the computer. It is an important component of a computer system which controls all other components of the computer system. It helps us to communicate with the computer without knowing its language. Without an Operating System the computer is of no use. Some of the commonly used Operating systems are Windows, DOS, UNIX, etc.

6. Differentiate between UNIX and DOS.

Ans.

UNIX	DOS
It is one of the oldest, reliable and powerful Operating systems developed at AT&T's Bell Laboratories in the early 1970's.	After Unix, DOS is one of the most commonly used operating System written originally by Tim Patterson.
It supports multiuser and multitasking.	It is a single-user operating system.

7. What is a Taskbar? What does it contain?

Ans. It is the thin strip present at the bottom of the screen. By default it is always visible at the bottom but we can choose the auto hide option in the taskbar settings which will disappear the task bar. But it will reappear only when the mouse cursor moves down to that area. It contains the following important components: Start Menu, Quick Launch Program icons, Notifications Area, System Clock, Show desktop button.

8. Mention features of Mobile Operating system.

Ans. Some of the important features are:

- It has a Graphical user interface with menus and buttons supporting different types of apps.
- It has a strong multitasking feature.
- It allows a device to easily interact in short distance or long distance communication.
- Some of the commonly used mobile OS are Android, iPhone OS, Symbian OS, Windows OS, etc.

9. Mention advantages of using email.

Ans. The following are the advantages of using email:

- Sending and receiving emails is a fast way of communicating as compared to the traditional mails.
- Emails can be sent anytime. That means it's not restricted to only working days or working hours.
- Emails can be sent to one or multiple recipients without much effort and at no cost.
- It is an inexpensive way of mailing as it only requires an Internet connection.

10. Mention main objectives of digital India.

Ans. The main objectives of this initiative are:

- To provide a high speed network in the rural area.
- To provide governance and services on demand.
- Digital empowerment of every citizen of India.
- Restructuring many existing schemes under Digital India Programme so that they can be implemented in a synchronized manner.

C. Give one word for each of the following statements:

1. Printed copy of a document.
2. Software that is designed for the users and are made to do a specific kind of work.
3. Part of the CPU that is responsible for all arithmetic and logical calculations.
4. The other name for Monitor.
5. Permanent and external memory of the computer.

D. Competency-based/Application-based questions:

#Experiential Learning

1. If you have filled-out an admission form for a college and need to send an email to the college authorities. Which device you will use to send the form?

Ans. You can scan it using the scanner and then e-mail it to the college instead of sending the actual form by post.

2. There is a talent contest in your town. For participating in the audition, you have to send a recording of a song. What would you connect to your computer to record your song?

Ans. Microphone

Unsolved Questions

SECTION A (Objective Type Questions)

Quiz

A. Tick (✓) the correct option.

1. Which of the following is telecommunication between two or more people using video/audio transmission?
   a. Video Conferencing ◯ b. Chatting ◯
   c. Messaging ◯ d. Mail ◯

2. Which of the following serves as a link for connecting many web documents to simplify the process of web browsing?
   a. Internet ◯ b. Webpage ◯
   c. Hyperlink ◯ d. Website ◯

3. Which of the following is a company that provides Internet connection and its services to people or an organisation?
   a. Web Client ◯ b. Web server ◯
   c. Web Browser ◯ d. Internet Service Provider ◯

4. What is the term used when you press and hold the left mouse key and move the mouse around? [NCERT]
   a. Highlighting ◯ b. Dragging ◯
   c. Selecting ◯ d. Moving ◯

5. Which short cut keys is used for Find Option?
   a. Ctrl + X ◯ b. Ctrl + H ◯
   c. Ctrl + F ◯ d. Ctrl + P ◯

6. Which of the following is a web browser? [NCERT]
   a. Internet ◯ b. Chrome ◯
   c. Windows ◯ d. None of these ◯

B. Fill in the blanks.

1. ..... is the use of hardware, software and networking technology for accessing, storing, retrieving and transmitting the information.
2. Banking transactions through an online mode are called ..... .
3. ..... are methods used to pass data and information to people involved in the ICT system.
4. ..... is a simple video sharing platform that allows users to like, share, download, upload videos, etc.
5. The standardised sets of rules that govern the transmission of data and information efficiently between different computers connected in an Internet are called ..... .
6. The first page displayed when you visit a website is called a ..... .
7. ..... is the address of the web file located on a web server that can be accessed using any web browser on the Internet.
8. ..... option is used when you want to send a copy of an email to another person without bringing it to the knowledge of a recipient.

C. State whether these statements are true or false.

1. Information received using a computer is highly reliable. .....
2. Software that are required to control the functions of a computers are called Applications software. .....
3. Bit is the smallest measuring unit for computer memory. .....
4. Each file in a computer may or may not have a unique name. .....

5. Mouse is an important output device in a Graphical user Environment like Windows. .....
6. A website is owned only by an individual. .....
7. Each device connected to the Internet has a unique IP address. .....
8. We can attach any text file as an attachment in the email. .....

D. Identify the following as Input, Output or Storage Devices:

Plotter, Microphone, Flash Drive, Speaker, Scanner, Printer, Hard Disk, Bar code Reader, Light pen, Projector

E. Differentiate between:

1. System and Application software
2. Cold and Warm Booting
3. Serial Port and Parallel Port

F. Name the protocols used to do the following:

1. It is responsible for efficient transfer of emails from the source computer to the destination computer on the Internet.
2. It is the main protocol of the Internet and is made up of two protocols.
3. It helps in efficient sharing and transmission of large files and folders in the Internet.
4. It is a secured version of HTTP.

SECTION B (Subjective Type Questions)

A. Short answer type questions:

1. Define Blu-ray disc.
2. What do you mean by Mobile operating system?
3. What is a light pen?
4. What are laser printers? Where are they used?
5. What does Motherboard consist of?
6. Give full form of the following: [CBSE Handbook]
   a. ALU
   b. CU
   c. CPU
7. Name the unit of computer that controls the flow of data from input device to memory. [CBSE Handbook]
8. Give two points of difference between email and postal mail.
9. What are protocols? Give two examples.
10. Differentiate between a file and a folder.
11. Give any two uses of ICT at home. [NCERT]
12. Neetu has the phone numbers of all her friends. She wants to share her recipes along with food photos with all her friends. What type of messaging service should she use?
13. Raghav wants to explore various types of travelling videos for his travel portal. Which website should he use?
14. Identify the following symbols and write the name in the blank space: [NCERT]

a. .....

b.

.....

c. .....

d. .....

B. Long answer type questions:

1. Explain any two different types of operating systems.
2. Name all the components of ICT with example.
3. Why is the motherboard an important component of a computer?
4. Explain the IPO cycle with an example.
5. What is the difference between input and output devices?
6. Differentiate between windows and Linux operating systems.
7. Mention important features of UNIX.
8. Write down steps to shut down a computer.
9. What are the functions of an operating system?
10. Write steps to create an email account.
11. What is the meaning of Digital India?
12. What are the different parts of an email address? Explain them.

C. Competency-based/Application-based questions:

#Digital Literacy

You want to send an e-Mail message to your friend Sushil. In which order will you perform the given steps to write and send an e-Mail to him? [CBSE Handbook]

i. Type Sushil's e-Mail address, subject and message

ii. Click on the Compose button

iii. Click Send

iv. Open your e-Mail account.

a. (iv)>(ii)>(i)>(iii)
b. (iv)>(i)>(ii)>(iii)
c. (iv)>(i)>(iii)>(ii)
d. (iii)>(i)>(ii)>(iv)

#Experiential Learning

Lab Activity

1. Make a presentation on "Digital India Initiatives" taken by Government of India.
2. Prepare a digital poster on "ICT tools in school".
3. Prepare a presentation on "Impact of ICT in Covid times".
4. Create a PowerPoint presentation on the topic 'Output Devices'. Use appropriate pictures and animations. After creating the presentation, present it in front of the class.
5. Make a chart to show Keyboard shortcut keys to do various tasks in the Windows environment.
6. Make a collage of some of commonly available icons in Windows.
7. Make a folder with the name "Class-IX". Under this make a folder of your name with the section.
8. Create an email account on an email service provider website other than Gmail.

Class Activity

#Collaboration & Teamwork

1. Activity-Past, present and future use of ICT [NCERT]

   Materials required: Diagrams or models of the basic computer components, actual samples or illustrations of peripheral devices, chart sheets, sketch pens and pencils

   Procedure:

   - Form groups of five students each
   - Each group will divide the chart paper into three columns.
   - Each group will choose one topic related to the past present and future use of ICT

2. Activity- Connecting devices to a computer. [NCERT]

   Materials required: Pen/pencil, notebook, computer

   Procedure:

   - Form groups of 5 students in each group.
   - Each member of the group connects one of the parts of the computer, such as printer, monitor, keyboard, mouse and the speakers to the central processing unit.
   - Fit the cables into the correct ports as explained and check if each device is working properly.

Answers

Exercise (Section A)

A. 1. b 2. c 3. b 4. c 5. d 6. b 7. d 8. d 9. c 10. a

B. 1. Communication Technology 2. E-Commerce 3. Information 4. spammer 5. Tablets
6. Body 7. WhatsApp 8. Spam 9. web browser 10. cc (carbon copy)

C. 1. True 2. False 3. False 4. True 5. True 6. True 7. False 8. False 9. True 10. False

Exercise (Section B)

C. 1. Hardcopy 2. Application Software 3. ALU (Arithmetic Logic Unit)
4. VDU (Visual Display Unit) 5. Secondary memory

UNIT-4

ENTREPRENEURIAL SKILLS-I

Learning Outcomes

- Definition of Business
- Who is an Entrepreneur?
- Some Important Terms in Entrepreneurship
- Steps for Starting a Business
- Qualities of an Entrepreneur
- Difference between Businessman and Entrepreneur
- Types of Business Activities
- What is Entrepreneurship?
- Entrepreneurship Development
- Characteristics of an Entrepreneur
- Role of an Entrepreneurship

After climbing up the ladder of your education, you need to focus on your inner strengths and find out what are the real long-term plans of your life. You may have to decide whether you should go for a job with a fixed salary that you will be getting every month or you should go for business. If you decide to do business, then you might have to further decide whether doing a family business will be a good option for you or you want to try your luck and skills in your own startup. Both paths have their own advantages and disadvantages. This chapter is all about giving you an insight into different types of business around us.

Definition of Business

A Business is a state of being busy as an individual or as an organisation in a profit earning economic activity. It is also defined as a continuous money-making activity by producing, buying or selling products or services. It is a commercial activity of providing goods and services for earning profits.

Nowadays, along with profit, customer's satisfaction is equally important for a successful business. A business can be **small-scale**, owned by a person or its family members, with profits or losses shared among them. Examples of small businesses include selling flowers grown on their own farms, operating eateries or cafes in local markets, and selling ready-made garments locally. Another category can be a **large-scale** business with its chains all over the country or across the world, with its profits shared amongst the owners and its employees. For example, pizza food chain, ready-made apparels chain etc.

Types of Business Activities

There are majorly three types of business activities:

Product business

A business that is involved in the production and sale of any product. This type of business involves activities related to the manufacturing, distribution, and marketing of a product. For example, a sports shop, furniture shop.

There are two types of product-based businesses:

- **Manufacturing:** This kind of business uses raw materials, labour, technology, capital and other resources for the production of finished goods. It follows a step-by-step approach of putting together raw materials, parts and components, moving from one workstation to the other with the help of technology, machinery, robots, computers, and labour.

  Finished goods are sold to the wholesalers, who in turn sell them to retailers. The consumers generally purchase these finished goods from the retailers. Some of the examples of manufacturing businesses are that of food, beverages, apparels, furniture, mobile phones, laptops, cosmetics and many more.

  Let us understand this with the help of a case study given below:

  ✶ **Precision Engineering Ltd.**

  Precision Engineering Ltd. specialises in manufacturing precision components for aerospace and automotive industries. Founded by a team of engineers with expertise in machining and fabrication, the company started in a small workshop but quickly gained recognition for their high-quality products and adherence to industry standards. They invested in state-of-the-art machinery and continuous staff training to maintain their competitive edge. By fostering long-term relationships with key clients and expanding their product range to include customised solutions, Precision Engineering Ltd. established itself as a trusted manufacturer in a competitive market.

- **Trading:** This deals with buying and selling a product. In this, the finished products are purchased at wholesale price and sold to consumers at retail price. The form of the products is not changed but the products are sold at a little higher price than the purchase price that helps them to earn profits. They also transport the product from the factory to warehouses. Examples of these businesses include wholesalers, distributors and retail shops.

Service business

This kind of business provides services in the form of consulting, accounting, hospitality and many more of such types which can be delivered either physically or in a digital form through the Internet or mobile apps. These services are not in the physical form which can be touched or stored or bought from the retailers. They are provided by professionals or experts in such areas. Salon is an example of Service business.

Let us understand this with the help of a case study given below:

- **CleanTech Solutions**

CleanTech Solutions provides eco-friendly cleaning services to residential and commercial clients. Founded by Anirudh, who was passionate about sustainability, the business began with a focus on using non-toxic cleaning products and energy-efficient practices. Through targeted marketing campaigns and partnerships with environmentally-conscious businesses, CleanTech Solutions gained traction in the local market. They expanded their service offerings to include specialised cleaning services for sensitive environments like hospitals and schools, demonstrating their commitment to innovation and client satisfaction.

Hybrid

Hybrid business is a mix of two or more different types of businesses. It can be in service or manufacturing or merchandising or all of these. It does business in the form of goods and services. For example, a restaurant is in manufacturing by preparing a ready to eat food in the form of fine dining. At the same time, it works as a merchandiser by selling beverages with the fine meals. It also provides services by serving home deliveries through online or offline orders.

Let us understand this with the help of a case study given below:

- **Sarah's Boutique**

  Sarah started a small boutique selling handmade jewelry and accessories. Initially, she operated from a physical storefront in her local community. As her business grew, Sarah expanded online, leveraging e-commerce platforms and social media to reach a wider audience. She diversified her product range based on customer feedback and market trends. By maintaining quality craftsmanship and personalized customer service, Sarah's Boutique established a loyal customer base both offline and online.

Difference between Product Business and Service Business

Factors	Product Business	Service Business
Seen and Touched	Product can be seen and touched. Customer pays for physical exchange of things.	Service cannot be seen or touched. Customers here pay for an experience.
Stored	A product can be stored in a shop or a warehouse (usually).	A service, for example, cutting hair, cannot be stored. Service is provided when a customer asks for it.
Made and Transported	A product can be made either at home or in a factory. After production, it is transported to different places where shopkeepers sell it.	A service cannot be made or transported. It is provided to the customer at the time of delivery.
Same quantity and quality	The quality and quantity of the product will be the same every time.	The quality and quantity of a service can be different at different times.

Reboot

1. Explain any two types of business.

2. What is hybrid business?

3. What do you mean by "service" in business?

Who is an Entrepreneur?

The word "**Entrepreneur**" is derived from the French verb 'entreprendre' which means "to undertake". An Entrepreneur is a person who invests his time, energy and money to initiate an exclusive idea for a new venture. He starts his own start-up with the desire to establish it. He may earn profits or bear losses and is wholly responsible for the unpredictable failures and risks.

They are the innovators of the market who see opportunities where others see roadblocks. The success of these business innovators is undoubtedly essential to change our economy for the advancement of our societies.

Entrepreneurship is the act of executing an innovative idea in a business. The output of this innovative process of setting up a business is called an **enterprise**.

Let's take an example:

Go Green Company is a successful entrepreneur project where a group of 5 college students decides to give plants in their locality at cheaper price to support the Green Economy. In a year they got a wonderful response, so they decided to open up their own nursery and supply plants in the whole city.

So in this example:

Group of college students is an **Entrepreneur**.

Innovative ways of running their own business is **Entrepreneurship**.

The output of this innovative process is Go Green Company, which is the **Enterprise**.

What is Entrepreneurship?

Entrepreneurship is setting your own business in an innovative manner which may have great risks and desires to earn more profits. Entrepreneurship, thus involves taking risks with innovation, planning and decisions so as to increase productivity in any field business, agriculture, social work, education, etc. It thus plays an important role in the process of economic development. Entrepreneurship can be at small scale, medium scale or large scale in terms of products and services. There are four main elements of entrepreneurship:

- **Innovation:** It means doing something in a creative and different way. This is the key element of entrepreneurship. Opening a roadside restaurant is just like opening a business but bringing the element of "Home cooked food for the people in a Food Truck" is called an innovation in business.
- **Organisation:** This plays an important role if a startup is launched at a large scale with a big investment. Though an entrepreneur is a person leading the whole business with his ideas but the other employees working in an organisation are equally important for the success of the startup.
- **Risk bearing:** Doing a business with a new idea is always associated with risk. But taking a calculated risk is an important element of entrepreneurship. This will bring change in the society by bringing new products and services.
- **Perception:** Entrepreneurship should have a strong perception of running a business in an innovative manner. An entrepreneur should implement his plans and ideas in such a way that helps him achieve long term goals of his business with greater profits.

Let us read the story of Shashank. His story will help us understand a little more about entrepreneurship.

In a bustling city where time seemed to move faster than anywhere else, there lived a young man named Shashank. He had always been fascinated by technology and its potential to solve everyday problems. He worked long hours at a tech startup, but his mind constantly churned with ideas of his own.

One rainy evening, while waiting for a delayed train, he noticed a group of commuters struggling with their wet umbrellas as they entered the station. It was a familiar sight—dripping umbrellas left on floors, benches, and even against walls, causing slippery hazards. Recognizing this inconvenience, an idea sparked in his mind.

Over the next few weeks, he sketched designs during lunch breaks and late nights, envisioning a solution—a collapsible umbrella stand that could be easily installed in public spaces. It would provide a designated spot for umbrellas, minimizing clutter and enhancing safety. Excited by his concept, he shared his idea with a few trusted friends and colleagues who encouraged him to pursue it.

With determination, he refined his design, sourced materials, and meticulously crafted a prototype in his small apartment. Armed with a functional model, he approached local businesses and transportation hubs, pitching his innovative umbrella stand. Initially met with skepticism, He persevered, demonstrating the practicality and benefits of his invention.

Slowly but steadily, interest grew. Cafes, offices, and train stations began to install Shashank's umbrella stands, impressed by their simplicity and effectiveness. Word spread quickly among commuters and business owners alike, and soon, orders poured in from across the city. He found himself managing production, logistics, and customer inquiries, all while juggling his day job.

As demand soared, he made the leap to focus full-time on his venture. With support from investors who believed in his vision, he scaled up production, expanded his product line, and even developed an app to track umbrella stand locations and availability in real-time. His business, named "DriStop Solutions," became a staple in cities prone to rain, celebrated for its practicality and contribution to urban safety.

Years later, as he looked out from the rooftop of his thriving office, he couldn't help but marvel at how a simple observation on a rainy day had transformed into a successful enterprise. What began as a solution to a common inconvenience had grown into a testament to his passion for innovation and problem-solving.

Reflecting on his journey, he realised that recognising a need, seizing an opportunity, and nurturing an idea had been the pillars of his success. With a smile, he knew that his entrepreneurial spirit had not only made a difference in people's lives but also inspired others to see challenges as opportunities waiting to be solved.

Step 1: Put wet umbrella straight down into the slot

Step 2: And then umbrella is automatically wrapped in plastic bag

Step 3: Pull out umbrella toward front slowly

Brainy Fact

Ritesh Agarwal is one of the youngest entrepreneur in India. He is the founder of OYO rooms.

Some Important Terms in Entrepreneurship

Entrepreneurs take risks to make a profit. Let us now try to understand the meaning of the word profit and risk used frequently in entrepreneurship:

- **Profit:** The term "profit" refers to the financial gain that an entrepreneur gets or a positive difference between total income earned and total costs invested in running a business. Profit is the main indicator of a business's financial success or failure. For example, Nisha has recently started running her own flower shop. She made her quarterly report and found that her income is little more than her total expense. This brought confidence in her and she planned to keep a close watch to bring up the profit margins for future growth of her business.
- **Risk:** The term "risk" refers to a situation where the result is not known and could lead to a loss. Entrepreneurs often face a variety of risks as they initiate, develop, and operate their business. Understanding and managing risks are essential components of successful entrepreneurship. These risks can sometimes bring failures also in a business. For example, in the above situation where Nisha, a florist, has established her business well in a span of one year. She now wants to expand her business by opening another branch in a nearby city where the competition is very high and the cost of investment is also more but she is quiet confident and wants to take the risk because she feels risk is an integral part of entrepreneurship, and successful entrepreneurs understand the importance of identifying, assessing, and managing risks effectively.
- **Wage Employment:** It exists as a partnership between two entities : the employer and the employee. In this type of employment, an employee receives compensation for their work in the form of wages or salary. It does not involve risks and the amount paid is fixed with certain incentives irrespective whether an employer is having loss or profit in his business. The continuity of the service in case of wage employment depends on the terms and conditions laid down in the contract between the two parties, as well as the relationship between the employer and the employee.

  Let us understand the difference between Wage Employment and Entrepreneurship

Factors	Wage employment	Entrepreneurship
Nature of Work	Individuals work for an employer or a company and receive a fixed wage or salary in exchange for their labour.	Initiate and operate their own businesses. Responsible for their own profits and losses.
Risk and Responsibility	The level of risk is comparatively lower with stable income and job security.	Entrepreneurship involves a higher level of risk-taking. It has uncertainties, financial risks, and market fluctuations.
Income Structure	Employees receive a regular and predictable income in the form of wages or salaries.	Entrepreneurs' income is often variable and depends on the success of their business.
Job Security	Employees typically enjoy job security as long as they adhere to the terms and conditions of their employment contracts.	Entrepreneurs face the risk of business failure, which may result in financial losses and sometimes closing of the business.

Factors	Wage employment	Entrepreneurship
Work Structure	Employees follow a predefined work structure with assigned tasks and responsibilities.	Entrepreneurship involves diverse roles, including marketing, finance, operations, and strategic planning.

Entrepreneurship Development

Entrepreneurship development is the process of enhancing knowledge and improving skills of an entrepreneur through structured training and classroom programs. Through this process, a person is equipped with the required skills and knowledge needed for starting and running the enterprise. Hence, this will be a big effort in preparing new entrepreneurs which will pave the way for a better economy and make the path for the creation of a developed society.

Entrepreneurial Development Programs have been designed and supported by the government of almost all countries to develop entrepreneurial abilities among the interested people. These programs help them to identify, develop, polish and strengthen their entrepreneurial skills so that they play their entrepreneurship role effectively and become a successful entrepreneur.

Steps For Starting a Business

Starting a business involves planning, making financial decisions, doing market research, and acquiring knowledge in areas you never thought you would learn about before. If you are planning to start your own business, then you should follow certain steps:

Step 1 **Plan and finalise a business idea:** This is a very important step where you make a choice of starting your own business with your planned idea. This could be:

- Something you are interested in.
- Something related to your skilled learning.
- Something that the market requires.

Step 2 **Plan and finalise your finances:** Before you implement your business idea, you need to have a clear picture of your financial status. You need to figure out how much money you'll need to start your business and let it survive for at least a year without profits. The money you are planning to invest in business will be:

- Taken from your savings and personal assets.
- Borrowed from banks or any other financial company.
- Utilised from the profit of some other business.

Step 3 **Choose your legal business structure:** Here, you decide whether you want to be a sole proprietor, or if you wish to start a business in a partnership, or you plan to start a Limited Liability Company. After this, you finalise aspects like business name, tax details, employee details, etc.

Step 4 **Finalise the business location:** Here, you finalise your business location based on the location of your target market, business partners and your personal preferences. You plan to buy, rent, or build the prime location. Factors like access to talents, network opportunities, business and investor friendliness, low taxes, etc. play an important role in this.

Step 5 **Build your team:** Depending on the size of the business, the team needs to be built. Job roles to be assigned, number of full time and part time employees required, different departments to be created, etc. are the factors to be taken into account while building a team.

Step 6 **Target the prospective customers:** Through target advertising, surveying customers, customer support services, etc., you can reach your customers. Through them you have a fair picture of your customers' likes and dislikes and your improvement areas.

Step 7 **Promote the business:** This helps you to bring your business straight to potential customers. It can be done through advertisements on TVs, radios, newspapers, social media, etc. If it is a small scale business, then promotion is done through pamphlets in newspapers.

Step 8 **Feedback in the long run:** It is important to take feedback from the customers in the long run. You can use the feedback to improve your product and reach out to a larger group for future expansion of the business.

Characteristics of Entrepreneur

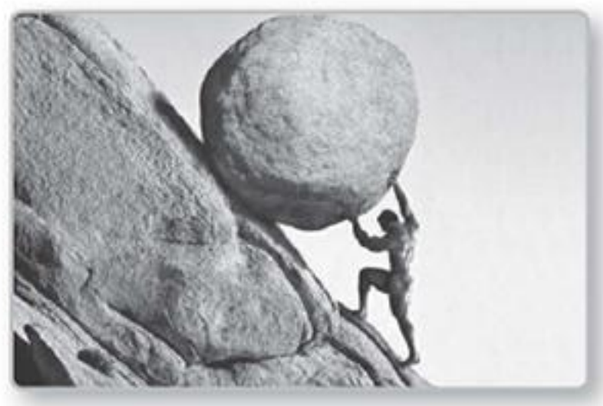
Let us now look at some of the distinguishing characteristics of entrepreneurship.

- Ability to take up risks.
- Believe in hard work and discipline.
- Adaptable and flexible to achieve the goals of enhancing quality and customer satisfaction.
- Knowledge of the product and services and their need or demand in the market.
- Financial literacy and money management skill.
- Effective planning, communication skills and execution.

Qualities of an Entrepreneur

A person who does not take risks, is not open to new ideas and is running the business only to earn a steady source of income is not an entrepreneur. An entrepreneur needs to have the following set of qualities to make his business grow:

- **Patience:** Entrepreneurship often involves facing challenges and uncertainties. Patience is essential to handle difficult times and waiting for the efforts to be paid, especially at the time of dealing with setbacks. It allows entrepreneurs to maintain a long-term perspective and make strategic decisions.
- **Positivity:** A positive mindset is essential in overcoming obstacles and setbacks. It helps entrepreneurs to stay focused on solutions rather than problems even when he/she takes a big risk.
- **Hardworking, Never Giving Up and Perseverance:** Hard work is the foundation for building and sustaining a successful business. Entrepreneurs should never give up in attaining their goals, even at the time of failures. It is important to learn from setbacks and keep on moving towards their goals.



- **Confidence:** Confidence plays a crucial role in making decisions, taking risks, and leading a team. Entrepreneurs need to believe in their abilities and vision to inspire trust in others, including employees, investors, and customers. Confidence brings vision and helps them navigate through uncertainty.
- **Open to Trial and Error:** Entrepreneurs need to be open to new ideas and try them without fear of failure. Being open to trial and error allows entrepreneurs to adapt their strategies, refine their approach, and discover what works best for their business.

- **Creativity and Innovation:** Creativity is the driving force behind innovation. Entrepreneurs must have a creative mindset so that they can identify new opportunities, solve problems, and differentiate their products or services in the market. This will help their businesses stay competitive and adapt to changing environments.

Role of an Entrepreneurship

Entrepreneurship plays a crucial role in both social and economic development, contributing to job creation, innovation, and the overall well-being of communities. Countries which encourage entrepreneurship have grown fast.

Let us discuss the social and economic role of an entrepreneurship in detail:

- **Economic Development—Money in Circulation:** An entrepreneur provides better and cheaper products and services for customers that brings economic growth. As entrepreneurs grow their business, investors put money into their businesses and expect good returns. As more and more entrepreneurs create business opportunities, the economy grows.
- **Social Development—Creation of Jobs:** An entrepreneur starts their business initially on a small scale. If the business shows some profits and grows over time, then an entrepreneur needs to expand operations, creating more jobs. Good quality jobs enable more people to earn money and have a good life.
- **Improved Standard of Living—More things available to live a comfortable life:** When an entrepreneur is involved in selling goods like automobiles, furnitures, real estates, mobile phones and mobile service then it helps people to live a more comfortable life.
- **Optimal Use of Resources:** Entrepreneurs contribute a lot in different ways in exploring both renewable and non-renewable natural resources present around us so that these natural resources can be used in optimal ways that reduces costs and increases their profits.
- **More Benefits at Lower Prices Products and Services at Competitive Prices:** Entrepreneurship plays a crucial role in providing more benefits at lower and competitive prices by driving market competition, increasing innovation, and keeping costs low, ultimately benefiting consumers and contributing to economic growth and development.

Benefits of Entrepreneurship

The various benefits of entrepreneurship include the following:

- **Do what you are interested in:** Entrepreneurship helps the entrepreneurs to pursue their passions and interests, allowing for greater creativity and innovation in their work.
- **Work for yourself, and not for others:** Entrepreneurship provides the freedom to design work hours, select projects, and work from any place. Entrepreneurs can decide the kind of work they would like to do and how they want to do it.
- **Make profits for yourself:** As an entrepreneur, one can decide how much money they want to earn and how much they want to invest in the business. They decide on the salary, wages and incentives of the employees.

- **More risk, more profit:** Entrepreneurship involves the risk of failure, but successful entrepreneurs are often courageous and ready to take risks. Taking risks can lead to greater financial success, as it allows entrepreneurs access to more resources.

Difference between Businessman and Entrepreneur

It is generally assumed that an entrepreneur and a businessman are the same people but both of them have a different approach for their business. A businessman uses traditional ways of doing business but an entrepreneur goes for innovative ways of doing a business.

Let us see the main differences between the two:

Factors	Businessman	Entrepreneur
Meaning	A businessman is a person who starts a business based on an idea already existing in a society. For example, opening a grocery shop, mobile shop, etc.	An entrepreneur is a person who starts an enterprise with a new idea or concept. For example, selling products through online services.
Market Status	Market Player who creates his own place in the existing market.	Market Leader who creates his own market.
Risk Factor	Risk factor is less.	Risk factor is high.
Procedures	Businessman follows traditional procedures.	Entrepreneur follows unconventional procedures.
Competition	High.	Low.
Focus	Profits.	Customers, employees, profits and society.

At a Glance

- A business is a state of being busy as an individual or as an organisation in a profit earning economic activity.
- The main objectives of a business are to meet economic, social, employee and national goals.
- There are three types of businesses: Product, Services, and Hybrid.
- An Entrepreneur is a person who invests his time, energy and money to initiate an exclusive idea for a new venture.
- Entrepreneurship is the act of executing an innovative idea in a business.
- The output of the innovative process of setting up a business is called an enterprise.
- The main elements of entrepreneurship are: Innovation, Organisation, Risk Bearing, and Perception.
- Entrepreneurs help in increasing foreign exchange reserves of the country, thereby increasing economic development.
- An entrepreneur should have good social skills to build his network of potential investors, suppliers, customers, and creditors.
- Feeling a large responsibility for the business may sometimes be scary and brings a lot of mental instability. Funds management, unpredictable market, employees' reactions and sometimes less time for family may lead to emotional setback for an entrepreneur.
- An entrepreneur lives his own dreams. He can pursue what he is passionate about in his life.

Exercise

Solved Questions

SECTION A (Objective Type Questions)

Quiz

A. Tick (✓) the correct option.

1. In business, which of the following, along with the profits, is equally important?
   a. Family trips ○ b. Child education ○
   c. Old parents' medicine ○ d. Customer Satisfaction ○
2. Which of the following business type uses raw material, labour, technology, capital and other resources for the production of finished goods?
   a. Manufacturing ○ b. Service ○
   c. Merchandise ○ d. All of these ○
3. In which of the following business, service cannot be stored in warehouses or boxes?
   a. Manufacturer ○ b. Service ○
   c. Merchandise ○ d. Trading ○
4. Product business is of two types, one is manufacturing and other involves only buying and selling the product at a slightly higher price. What is the second type?
   a. Hybrid ○ b. Service ○
   c. Primary ○ d. Trading ○
5. The word "entrepreneur" is derived from the ..... .
   a. French verb ○ b. Latin verb ○
   c. Sanskrit verb ○ d. Arabic verb ○
6. What is the output of the innovative process of setting up a business called?
   a. Project ○ b. Business ○
   c. Enterprise ○ d. Work ○
7. What is the process of enhancing knowledge and improving skills of an entrepreneur through structured training and classroom programmes called?
   a. Entrepreneur ○ b. Entrepreneurship ○
   c. Business ○ d. Entrepreneurship Development ○
8. Which of the following is/are characteristic(s) of an entrepreneur?
   a. Risk Taking Ability ○ b. Hard working ○
   c. Good communication skills ○ d. All of these ○

B. Fill in the blanks.

1. A ..... is a state of being busy as an individual or as an organisation in a profit earning economic activity.
2. ..... businesses provide service by skilled professionals and experts.
3. Employees receive a regular and predictable income in the form of ..... .
4. It is important to take ..... from the customers in the long run.
5. Planning and finalising a business idea is the ..... step of starting a business.

6. Entrepreneurship should have a strong ..... of running a business in an innovative manner.
7. Doing a business with a new idea is always associated with ..... .
8. Entrepreneurs need to believe in their abilities and ..... trust in others.
9. An entrepreneur should be ..... to all circumstances.
10. Competition for businessman is ..... and entrepreneur is ..... .

C. State whether these statements are true or false:

1. Business is a money-making activity by thinking good thoughts. .....
2. A businessman should work for his own personal incentives. .....
3. Planning and finalising a business Idea is a very important step. .....
4. Entrepreneurs bring economic development through optimal use of resources. .....
5. An entrepreneur should always be disciplined, dedicated and hard working from a very early stage. .....
6. There is a regular income for an entrepreneur. .....
7. Entrepreneur is not a master of his own time. .....
8. Entrepreneurs cannot gain much profits. .....

SECTION B (Subjective Type Questions)

A. Short answer type questions:

1. Who is not an entrepreneur?

Ans. A person who does not take risks, is not open to new ideas and is running the business only to earn a steady source of income is not an entrepreneur.

2. Define profit.

Ans. The term "profit" refers to the financial gain that an entrepreneur gets or a positive difference between total income earned and total costs invested in running a business. Profit is the main indicator of a business's financial success or failure.

3. Mention any three different types of business.

Ans. There are different types of businesses:

- Manufacturing
- Service
- Hybrid

4. What is the meaning of finalising the business location?

Ans. It means finalising your business location based on the location of your target market, business partners and your personal preferences. You plan to buy, rent, or build the prime location. Factors like access to talents, network opportunities, business, and investor friendliness, low taxes, etc. play an important role in this.

5. Define an Entrepreneur? Give examples.

Ans. An Entrepreneur is a person who invests his time, energy, and money to initiate an exclusive idea for a new venture. He starts his own startup with a desire to establish and earn profits and is wholly responsible for the unpredictable failures and risks. For example, flower selling business on a digital platform.

6. Name the four elements of entrepreneurship.

Ans. The four elements of entrepreneurship are:

- Innovation
- Risk bearing
- Organisation
- Perception

7. What do you mean by risk in a business?

Ans. Risk in a business means the probability of losing company's assets or profits due to high competition in the market, dynamic nature of customers or government rules and regulations.

8. Why is "Plan and finalise your finances" an important step in starting a business?

Ans. Before you implement your business idea, you need to have a clear picture of your financial status. You need to figure out how much money you'll need to start your business and let it survive for at least a year without profits.

The money you are planning to invest in business will be:
- Taken from your savings and personal assets.
- Borrowed from banks or any other financial company.
- Utilised from the profit of some other business.

9. What do you mean by "Promote the business"?

Ans. This helps you to bring your business straight to potential customers. It can be done through advertisements on TVs, radios, newspapers, social media, etc. If it is a small scale business, then promotion is done through pamphlets in newspaper.

10. List any four characteristics of entrepreneurship. [NCERT]

Ans. The characteristics of entrepreneurs are as follows:
- Ability to take up risks.
- Financial literacy and money management skill.
- Believe in hard work and discipline
- Effective planing and execution

B. Long answer type questions:

1. Explain in detail the hybrid type of a business.

Ans. Hybrid business is a mix of two or more different types of businesses. It can be in service or manufacturing or merchandising or all of these. It does business in the form of goods and services. For example, a restaurant is in manufacturing by preparing a ready to eat food in the form of fine dining. At the same time, it works as a merchandiser by selling beverages with the fine meals. It also provides services by serving home deliveries through online or offline orders.

2. What do you understand by the term "Open to Trial and Error"?

Ans. Entrepreneurs need to be open to new ideas and try them without fear of failure. Being open to trial and error allows entrepreneurs to adapt their strategies, refine their approach, and discover what works best for their business.

3. Give three differences between Wage Employment and Entrepreneurship.

Ans.

Wage Employment	Entrepreneurship
Individuals work for an employer or a company and receive a fixed wage or salary in exchange for their labour.	Initiate and operate their own businesses. Responsible for their own profits and losses.
The level of risk is comparatively lower with stable income and job security.	Entrepreneurship involves a higher level of risk-taking. It has uncertainties, financial risks, and market fluctuations.
Employees receive a regular and predictable income in the form of wages or salaries.	Entrepreneurs' income is often variable and depends on the success of their business.

4. What is the definition of perception in the context of entrepreneurship?

Ans. Perception in entrepreneurship refers to the strong understanding and insight into running a business in an innovative manner to achieve long-term goals and greater profits.

5. Explain any three important elements of entrepreneurship.

Ans.
- **Innovation:** It means doing something in a creative and different way. This is the key element of entrepreneurship. Opening a roadside restaurant is just like opening a business but bringing the element of "Home cooked food for the people in a Food Truck" is called an innovation in business.
- **Organisation:** This plays an important role if a startup is launched at a large scale with a big investment. Though an entrepreneur is a person leading the whole business with his ideas but the other employees working in an organisation are equally important for the success of the startup.
- **Risk bearing:** Doing a business with a new idea is always associated with risk. But taking a calculated risk is an important element of entrepreneurship. This will bring change in the society by bringing new products and services.

6. What is the role of entrepreneurship in economic development?

Ans. An entrepreneur provides better and cheaper products and services for customers that brings economic growth. As entrepreneurs grow their business, investors put money into their businesses and expect good returns. As more and more entrepreneurs create business opportunities, the economy grows.

7. Explain the term Trading.

Ans. This deals with buying and selling a product. In this, the finished products are purchased at wholesale price and sold to consumers at retail price. The form of the products is not changed but the products are sold at a little higher price than the purchase price that helps them to earn profits.

They also transport the product from the factory to warehouses. Examples of these businesses include wholesalers, distributors and retail shops.

8. Explain any three benefits of entrepreneurship.

Ans. The various benefits of entrepreneurship include the following:

- **Do what you are interested in:** Entrepreneurship helps the entrepreneurs to pursue their passions and interests, allowing for greater creativity and innovation in their work.
- **Work for yourself, and not for others:** Entrepreneurship provides the freedom to design work hours, select projects, and work from any place. Entrepreneurs can decide the kind of work you like to do and how you want to do it.
- **Make profits for yourself:** As an entrepreneur, one can decide how much money they want to earn and how much they want to invest in the business. They decide on the salary, wages and incentives of the employees.

C. Competency-based/Application-based questions:

#Creativity & Innovativeness

1. Mayank is planning to start his own business of selling readymade garments. Guide him what proper steps he should follow to start his own business.

   HINT: Write all points of "Steps of Starting a Business"

2. Vedika is interested in having her own start-up but she has no funds. She is totally confused between taking up a fixed salary job or live her dreams of starting her own company. She is your good friend how will you help her in taking a fair decision?

   HINT: Benefits of entrepreneurship.

Unsolved Questions

SECTION A (Objective Type Questions)

Quiz

A. Tick (✓) the correct option.

1. Which of the following terms describes a type of employment where an employee receives fixed compensation in the form of wages or salary from an employer?

   a. Wage employment ◯ b. Entrepreneur ◯

   c. Manufacture ◯ d. None of these ◯

2. What type of a business is a restaurant that offers services in the form of a dining experience and food served as the product?

   a. Hybrid ◯ b. Manufacturing ◯

   c. Service ◯ d. Both b. and c. ◯

3. A Toy Shop is a type of ..... business.

   a. Merchandise ◯ b. Manufacturing ◯

   c. Service ◯ d. Hybrid ◯

4. An entrepreneur stays focused on to the solutions rather than problems even when he/she takes a big risk. What quality is highlighted here?

   a. Patience ◯ b. Positivity ◯

   c. Confidence ◯ d. Hardworking ◯

B. Fill in the blanks.

1. Entrepreneur follows ..... procedures.
2. Selling an ice cream is a ..... business.
3. ..... Solutions provides eco-friendly cleaning services to residential and commercial clients.
4. The ..... and ..... of a service can be different at different times.
5. ..... helps you to bring your business straight to potential customers.

C. One word answers.

1. Name the business in which production of goods is done. .....
2. Pizza food chain is which category of business? .....
3. Name the person who does something innovative in a business. .....
4. Name the person who starts a business. .....

D. State whether these statements are true or false:

1. Business is an economic activity. .....
2. Manufacturing is a consulting business. .....
3. Sales people are unskilled labourers. .....
4. Main objective of a business is to survive and earn profits. .....
5. Entrepreneurs improve the standard of living. .....
6. An entrepreneur should have strong leadership qualities. .....
7. There are no fixed hours of working for an entrepreneur. .....
8. Entrepreneurs are in the control of market forces and cannot decide what kind of work they should do? .....
9. Entrepreneurs decide incentives of the employee. .....
10. The economy suffers due to entrepreneurs as they are inclined towards profits only. .....

SECTION B (Subjective Type Questions)

A. Short answer type questions:

1. Who is a businessman? Give a few examples.
2. What do you mean by "Feedback in the Long Run"?
3. Why is patience crucial for an entrepreneur?
4. Differentiate between an entrepreneurship and an enterprise.
5. What do you understand by the term wage employment?
6. What do you think is the biggest challenge of an entrepreneur?
7. What is the market status of an entrepreneur?
8. Susan is an MBA graduate in Sales and Marketing and now wants to start her own business. Her father is a cab driver and she neither has money to invest in her business nor wants to take any loan. She wants to go into a service business. Can you suggest some service businesses where with less investment she can start her own business?
9. What are the key differences between product and service-based businesses? [NCERT]
10. What is the definition of organisation in the context of entrepreneurship?

B. Long answer type questions:

1. Your cousin is planning to be an entrepreneur but he is in a dilemma whether to take risk or not. How can you help him convince to go ahead in living his dream of a successful entrepreneur?
2. What is the meaning of manufacturing and trading based business? [NCERT]
3. Write the steps of starting a business.
4. Explain in detail the process of entrepreneurship development.
5. What is entrepreneurship?
6. Explain any four qualities of an entrepreneur.
7. Differentiate between an entrepreneur and a businessman.
8. What is the role of entrepreneur in social development?

C. Competency-based/Application-based questions:

#Problem Solving & Logical Reasoning

1. State whether the person engaged in the activity mentioned below is an Entrepreneur or an Employee. [NCERT]
   a. Rahul starts a shop to sell Chaat and special Paani Puri. He is an ..... .
   b. Shahid becomes the manager of a dealership selling food products. He is an ..... .
   c. Ritu leaves the company she worked for and starts catering food for marriage programmes. She is an .....

2. State the type of business–product, service or hybrid. [NCERT]
   a. Arun bakery, which makes and sells bread to people.
   b. Ram's repair shop, which repairs motorcycle.
   c. Hari's hair-salon, where he cuts hair for women and men.

Lab Activity

#Experiential Learning

1. Make a presentation on "Important features of a Successful Entrepreneur."
2. Make a collage on "Entrepreneurs in Education."
3. Make a list of the types of business around you in your locality.
4. Divide the above list into Service, Product, and Hybrid categories.
5. Make a list of the possible Hybrid businesses available in the Food Industry.

Class Activity

#Collaboration & Teamwork

1. Explore the world of entrepreneurship. [CBSE Handbook]
   - Discuss in groups and prepare a chart to explain advantages of entrepreneurship, based on its characteristics, role and rewards.
   - Interact with 5 entrepreneurs in your community OR Read about any 5 successful Indian entrepreneurs and their success stories.
   - From the interviews/stories, identify at least 15 skills and qualities of a successful entrepreneur.
2. Activity-A successful interview. [NCERT]

   Procedure:
   - Form pairs of students. One student imagines him/herself to be a successful entrepreneur (maybe 10 years from now).
   - The other student will act as an interviewer from a TV channel who will interview this entrepreneur.
   - The interviewer asks questions given in the table below and note down the answers.
   - One volunteer pair will present their questions and answers to the class.

Questions	Your Answer
What business do you do?	
Why did you start this business and not take up a job in a company?	
How did you come up with the business idea?	
Were you successful when you first started?	
What did you find most difficult?	
How did you overcome this difficulty?	
Have you faced any failures? If yes, what?	
What advice would you give to others who are trying to start their own business?	

Answers

Exercise (Section A)

A. 1. d 2. a 3. b 4. d 5. a 6. c 7. d 8. d

B. 1. business 2. Service 3. wages or salaries 4. feedback 5. first
6. perception 7. risk 8. inspire 9. flexible 10. high, low

C. 1. False 2. False 3. True 4. True 5. True 6. False 7. False 8. False

UNIT-5

GREEN SKILLS-I

Learning Outcomes

- Ecosystem
- Relationship Between Society and Environment
- Natural Resources Conservation
- Activities that are Damaging our Earth and Environment
- Green Economy
- Green Projects in India
- Environment
- Natural Resources
- Saving Environment using 5R's
- What is Sustainable Development?
- Green Skills

All aspects of our lives are impacted by the environment we live in, and our daily actions have an impact on the environment as well. Cities are dependent on nearby villages for their food supply, and these communities in turn depend on woods, meadows, rivers, and seashores for resources like water, fuel wood, fodder, etc. These resources, derived from the interconnected web of life formed by plants and animals, sustain our existence. Similarly, our school environment is composed of both physical and sociocultural dimensions. The physical environment encompasses the school building, classrooms, library, laboratories, corridors, kitchen, toilets, garden, and playground—a backdrop essential to our educational pursuits and daily routines. In parallel, the sociocultural environment within our school is shaped by various factors. It includes the quality of teaching and learning climate established by educators, the diversity of student activities, inclusivity and respect for diversity, enriches our learning experience and community dynamics. These elements together create a supportive environment where learning thrives and students grow.

A balance in the environment is essential for the existence of a healthy life on this earth. Humans constantly interact with it in direct or indirect ways. Sometimes this interaction is biased and disturbs the balance of this mother earth, resulting in changes that affect all. We all need to understand its importance and work in the direction of saving it from all possible ways of destruction. In this chapter, we will learn some important facts about our environment and its relationship with society.

Ecosystem

An ecosystem is defined as a community where living and non-living things interact with each other and their surrounding environment to form a balanced system. Any imbalance in any of the components will disturb the whole ecosystem, which might create problems in the existence of other living organisms.

It is made up of two important components:

- **Biotic:** It refers to living organisms of the ecosystem which can be plants and animals. Plants are considered to be autotrophs which make their own food by trapping energy of the sun. This energy flows through all the other living components when plants are consumed by plant eating animals which inturn are eaten up by other bigger animals.

- **Abiotic:** Abiotic components are the non-living components of an ecosystem. It includes air, water, soil, minerals, sunlight, temperature, nutrients, etc.

There are two main types of ecosystem:

- **Terrestrial:** A terrestrial ecosystem is a community of living and non-living things on land. They live, develop and interact with each other in soil and air around them. It includes forest, grassland, desert, etc.
- **Aquatic:** An aquatic ecosystem is a community of living and non-living things in water. They live, develop and interact with each other in water around them. It includes marine and freshwater ecosystems.

Environment

'Environment' word is derived from the French word 'Environia' which means "to surround". In simple terms, it refers to our surroundings, consisting of physical, chemical, and biological elements that maintain a balance between the living and non-living components. It also impacts the growth and development of any life in the surrounding area. Our environment is classified into two basic categories:

Natural Environment

When all living and non-living elements occur naturally in our surroundings and affect life in its natural ways by encompassing interaction of all living species and natural resources, it forms our natural environment. Plants and animals living on land, in air, or water form our natural environment. It may be claimed as Abiotic and Biotic.

Man-Made Environment

It is the environment created by humans to create an atmosphere comfortable for him to interact and adjust to the natural environment. For example, permanent human settlements like villages, towns, cities, transport and communication facilities, factories, dams, etc.

Relationship Between Society and Environment

A group of people living together to form a tribe, village, or a city sharing common interests, and having constant social interactions forms a society. The people living in society need to interact with the environment to obtain their food, water, fuel, and many other things. They sometimes exploit the natural resources present in the environment for their own benefits, thus causing pollution and environmental damage. For example, humans have been cutting down forests to clear land to grow crops for centuries, and due to this deforestation there is a change in the climatic conditions.

Humans interact with the environment in two different ways:

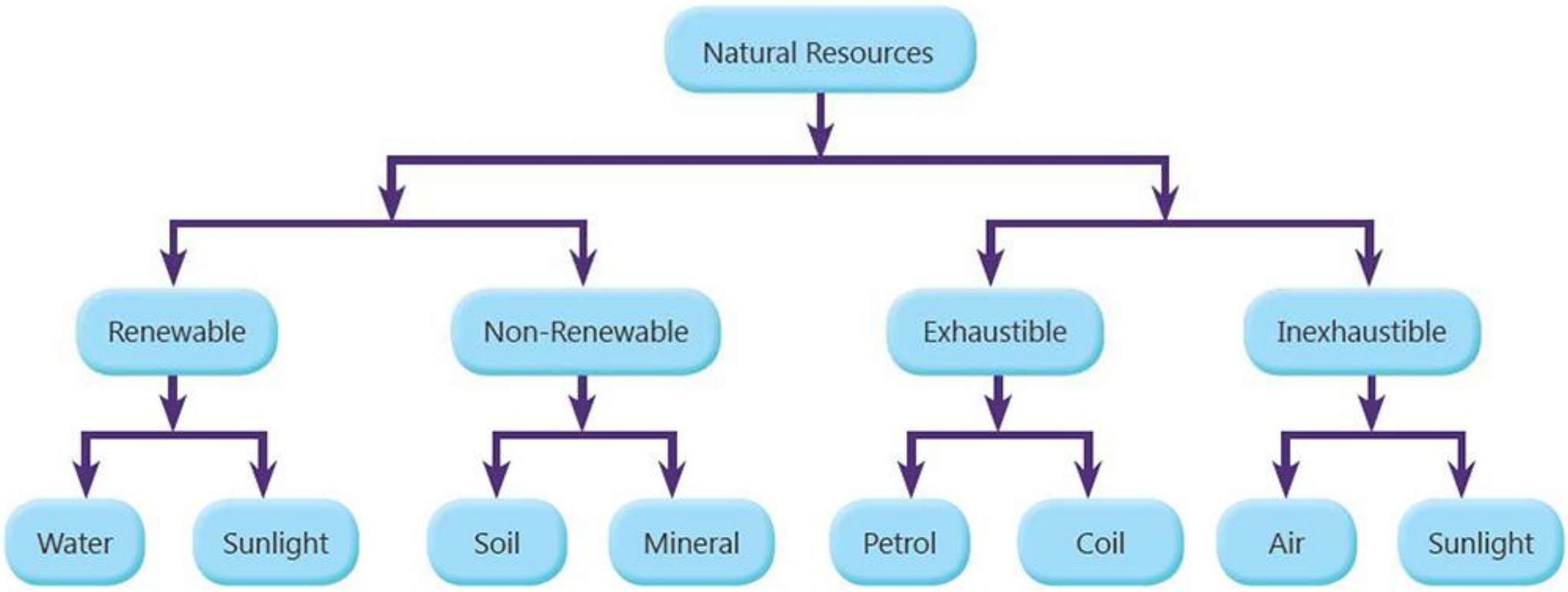
- By utilising natural resources such as land, plants, water, soil, minerals, food in terms of plants and animals.
- By modifying the environment through various activities such as industrialisation, deforestation, mining, building dams, etc.

Brainy Fact

The Constitution of India contains specific provisions for the protection and improvement of environmental quality. Article 48-A of the Constitution says that "the state shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country."

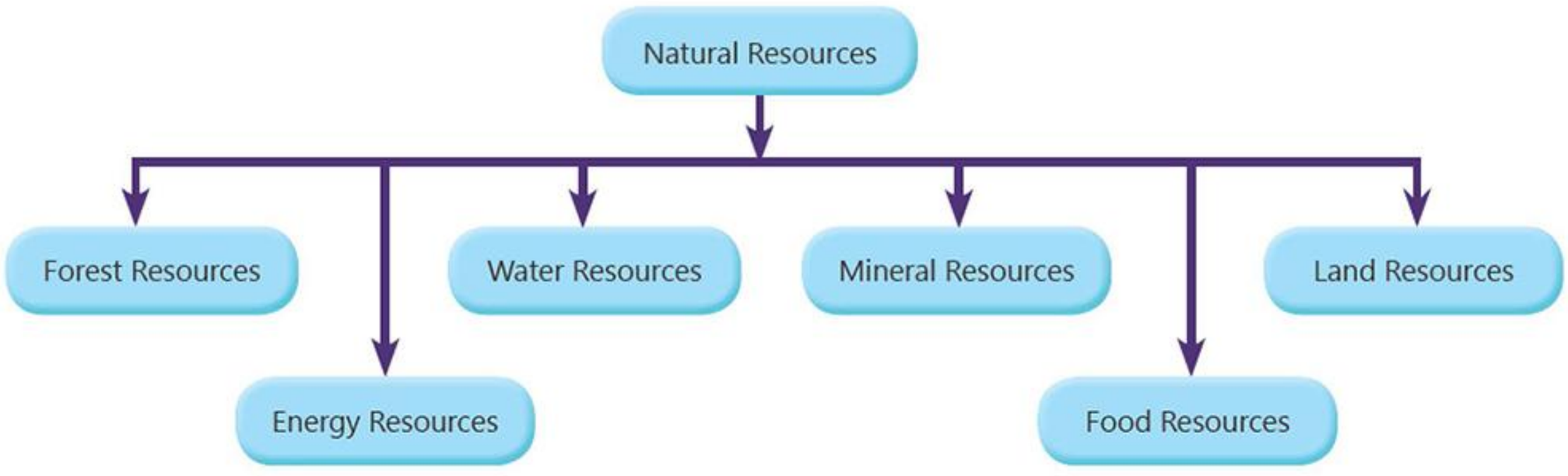
Natural Resources

The resources that exist without any intervention of humans and are present in abundance in our surroundings are called natural resources. These are air, water, land, plants, trees, sunlight, etc. Living organisms are dependent on these resources for their existence. The resources which are developed by human beings during the growth of civilisation are called artificial resources. For example, biogas, thermal efficiency, plastics etc. There are four types of natural resources:



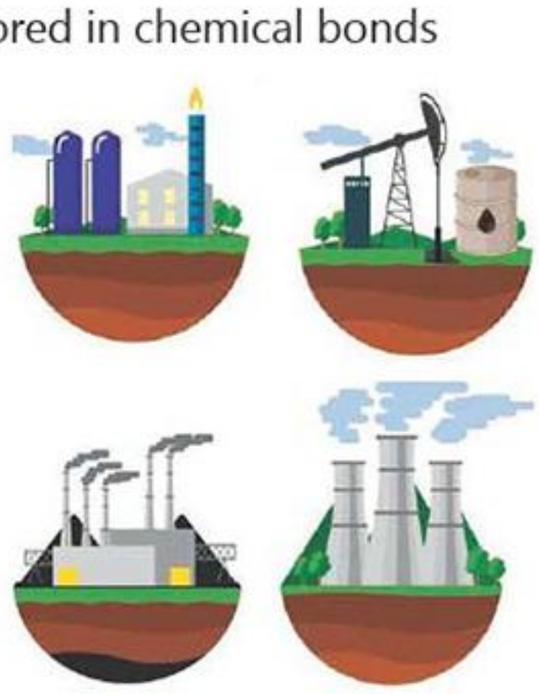
- **Renewable:** Resources which occur in abundance and are renewed on their own by our mother nature through the natural process of recycling, replacement, and reproduction are called renewable resources. For example, forest, wind, water, sunlight, geothermal (energy from the heat inside the earth).
- **Non-Renewable:** Resources that are limited and cannot be replaced at the same speed at which they are used up are called non-renewable resources. It takes millions of years to form inside the earth. For example, fossil fuels, minerals, natural gases, nuclear energy, etc. Non-renewable resources can be called inorganic resources if they come from non living things. For example, minerals, wind, land, soil and rocks.
- **Exhaustible:** Resources which are present in limited quantity and will deplete after a few hundred years due to their over consumption by human activities. For example, coal, petrol, natural gas, water, etc.
- **Inexhaustible:** Resources which are present in abundance and cannot be exhausted even by their over consumption are called inexhaustible resources. For example, wind, solar energy, etc.

Natural resources come in many forms. It may be a solid, liquid, or gas. It may also be organic or inorganic. It may also be metallic or non-metallic.

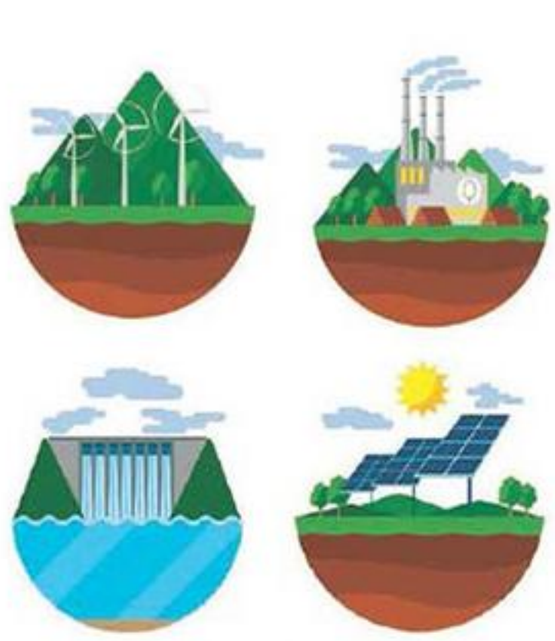


- **Land Resources:** Human beings use land as a resource for production as well as residence and recreation. It is a finite resource subject to both agricultural and non-agricultural uses, such as infrastructure development.

- **Forest Resources:** A forest is a natural, self-sustaining community characterised by vertical structure created by presence of trees. Wood is used for making furniture, tool-handles, railway sleepers, matches, ploughs, bridges, boats, etc. and as a source of energy for cooking purpose and for keeping warm. Tannins, gums, drugs, spices, insecticides, waxes, honey, horns, musk, ivory, hides, etc. are all provided by the flora and fauna of forests.
- **Water Resources:** Water covers about three quarters of Earth's surface and is a necessary element for life. Water resources include rivers, lakes, oceans, and underground aquifers, etc. Water is a vital resource in agriculture, industrial, household and recreational and environmental activities.
- **Mineral Resources:** A mineral deposit is a concentration of naturally occurring solid, liquid, or gaseous material, in or on the Earth's crust in such form and amount that its extraction and its conversion into useful materials or items are profitable now or may be so in the future. Mineral resources are non-renewable and include metals (e.g., iron, copper, and aluminium), and non-metals (e.g., salt, gypsum, clay, sand, phosphates). Some minerals consist of a single element, such as gold, silver, diamond (carbon), and sulphur.
- **Food Resources:** Resources that are used as food, or provide food for organisms are called food resources. Plants serve as food resources for herbivores and omnivores. Animals and birds are the source of food for many organisms who are carnivores and omnivores. Agriculture is the main source of plant food resource for human beings.
- **Energy Resources:** An energy resource is something that can produce heat, power life, move objects, or produce electricity. There are 5 fundamental sources of energy:
  - Nuclear fusion in the Sun (solar energy)
  - Gravity generated by the Earth and Moon
  - Nuclear fission reactions
  - Energy in the interior of the Earth
  - Energy stored in chemical bonds



Non-renewable Resources



Renewable Resources

Most of the energy we use today come from fossil fuels. But fossils fuels have a disadvantage in that they are non-renewable on a human time scale, and causes other potentially harmful effects on the environment.

Brainy Fact

28 July every year is celebrated as World Nature Conservation Day that focuses on conserving and protecting our natural resources.

Natural Resources Conservation

Natural Resource is the main reason for our existence on this planet. Many natural resources are present in the environment in abundance, some resources can ultimately perish due to increase in population and industrialisation. It is important to conserve these natural resources by doing our part in saving it for our future generation. The direct or indirect consumption of natural resources across the globe has led to their rapid depletion. As a result of this many countries of the world are calling for better means of managing and sustaining these natural resources.

Need to Conserve Our Natural Resources

We need to conserve our natural resources because of the following reasons:

- For our survival.
- To maintain our environmental balance.
- It is an important factor for the economic development of a country.
- It takes millions of years to replenish non-renewable resources.
- Due to increase in population and rapid urbanisation, these resources are getting exhausted at a higher rate.

Brainy Fact

China has the most natural resources estimated to be worth $23 trillion, 90% of which are coal and rare earth metals.

How To Conserve Our Natural Resources

Natural Resources are consumed by living organisms directly or indirectly for their existence. Conservation of natural resources helps in maintaining an ecological balance. We can conserve it for our future generations by protecting it in different ways as discussed below:

Water Conservation

Water is an essential natural resource for the existence of life. Our body is made up of 70% of water. We need water for agricultural, industrial, household and recreational activities. We can conserve water by using the given measures:

- By doing rainwater harvesting.
- Setting up water treatment plants to reuse the water for irrigation or other purposes.
- Judiciously using water at homes, restaurants, social gatherings and workplaces.
- Growing more vegetation in rain deficient areas to trap rainwater and hold underground water.
- Proper disposal of sewage and industrial wastes, so that it does not contaminate the water bodies around it.
- Building dams and reservoirs.

Soil Conservation

Soil contains important minerals which are used as nutrients for plants. These plants are the basis of food for all living organisms including man. Soil is also a home of many microorganisms that fix nitrogen and decompose organic matter. Loss of soil and its fertility can be due to several reasons like land overuse, erosion, salinisation, and chemical contamination. We can conserve soil by using the given methods:

- **Afforestation:** Planting more trees on the land with few or no trees is called afforestation. Trees are used to anchor the soil and reduce the amount of soil erosion undergone by that area. It also helps to offset excess carbon emitted by industries.

- **Terrace Farming:** It is a method of cultivation of crops especially rice in hilly areas. In this method, the sloppy land is carved into steps for planting crops. Each step has a mud barrier to prevent the washing away of soil nutrients by the rain water. It also helps in reducing water loss and soil erosion.
- **Changing Agricultural Practices:** Retaining soil nutrients and preventing soil erosion can be done by following changed agricultural practices like:

  - **Crop Rotation:** It is the system of cultivating different varieties of crops on the same piece of land across different seasons. This helps to conserve soil fertility as different crops have different requirements of soil nutrients.
  - **Contour Ploughing:** In this method, the soil is ploughed along the contour to decrease the soil runoff. By growing the crops in a contour pattern, plants can absorb more rain water and thus minimise the soil erosion.
  - **No-Till Farming:** It is a method of growing crops without tilling the soil. This practice will not disturb the top layer of soil and the last crop present in the top layer will be decomposed fast which helps in maintaining the soil nutrients and preventing soil erosion.
- **Wind Breaks:** Dense rows of tall evergreen trees are planted around the boundaries of farm. This reduces wind pressure and helps in preventing soil erosion due to wind and rain water.
- **Salinity Management:** The water, after evaporating from the soil, leaves behind salt. It is generally seen in the areas near sea, lakes, oceans and in weathering of rocks. It affects soil fertility and reduces absorption of water by plant. Using humic acids can prevent this or growing crops like saltbush can rejuvenate soil and replenish lost nutrients.
- **Earthworms:** Earthworms are considered as best friends of farmers. By introducing more earthworms, we can increase the fertility of soil. They eat up the soil and fungi present in it due to no-till farming, digest the organic matter present in it and excrete wastes full of plant nutrients known as worm cast which makes soil fertile. They aerate the soil by making burrows.
- **Stream Bank Protection:** During the rainy season or floods, the vegetative cover of the stream bank is often washed away into the stream, leading to soil erosion. This can be prevented by forming vegetation, constructing rock ripraps, planting trees, and growing native grasses and shrubs along a stream bank.

Energy Conservation

Energy conservation involves preserving of non-renewable resources like coal, oil, and natural gas by using it judiciously and reducing its wastage, so that it can be preserved for the generations to come. Increase in the consumption of oil and natural gas has lead to an increase in the level of carbon dioxide causing change in climatic conditions. There are different ways to conserve energy:

- **Using alternate sources of energy:** There are many alternate sources of energy that can be utilised for different purposes:
  - Wind Energy
  - Geothermal Energy
  - Solar Energy
  - Nuclear Energy
  - Tidal Energy
  - Biofuels and Biomass Energy
- **Using energy efficiently:** This is an important factor for environmental protection, financial benefits for individuals and for the country as a whole. Following the method given below will be a great help in the consumption of energy efficiently:
  - Using maximum daylight, CFLs, turning off electrical appliances when not in use.
  - Using energy efficient appliances at home and in offices. It consumes less energy and saves more money.
  - Using public transport, carpooling, driving less, and walking more or using a bicycle for small distances.
  - Keeping the doors closed for efficient use of air conditioners.
- **Creating awareness among people:** If we create awareness among our people, then half of the battle in conserving energy is won. This awareness can be brought by:
  - Educating people for efficient use of energy at homes and in offices.
  - Supporting campaigns and government initiatives for consumption of alternate sources of energy.
  - Going for Reduce, Recycle, Repurpose, Refuse and Reuse of the available resources.

Food Conservation

Natural Resources used as food for the living organisms are called Food Resources. Conservation of food resources will help retain the nutritional value of food and avoid its wastage. It serves to feed mankind in times of adverse conditions like war, natural calamity, food shortage due to climatic change, etc.

The given methods for conserving food are used at different stages of food transfer from producer to consumer level:

- **Cooling:** Certain varieties of food can be refrigerated, while others can be frozen to stop the growth of harmful microorganisms like bacteria, mould, fungi, etc. on the food, thus preventing it from being unfit for consumption.
- **Heating:** Microorganisms are destroyed by heat at specific temperature. This process includes pasteurisation, cooking, and sterilisation.
- **Removing moisture from food:** This will hinder the growth of microorganisms on food by drying, salting, pickling, sugaring, and smoking food.
- **Use of preservatives:** Food preservatives like Sodium Benzoate, Parabens, Formaldehyde, etc. are used to increase the shelf life of food items by keeping it fresh for a long time.

Forest Conservation

Forest is an important renewable resource and is made up of living and non-living components. It has plants in the form of trees, shrubs, climbers, grasses, and herbs. It provides us food, fodder, fibre, fruits, and fuel. It also regulates the temperature of a place and helps in conservation of soil.

To conserve this natural vegetation that exists from thousands of years, follow the given methods:

- **Control deforestation:** Due to rapid urbanisation and the construction of dams, forests are cut to clear land. Cutting should be regulated by :
  - ✶ **Clear cutting method:** If the same types of trees are available over a large area, then trees of the same age group can be cut down in a selected area and then marked for replantation.
  - ✶ **Selective cutting method:** Only mature trees are selected for cutting. This process is to be followed in rotation.
  - ✶ **Shelter wood cutting method:** Trees are cut on the basis of their utility of providing timber. Trees of lesser importance are cut first, followed by trees of moderate importance and at the end the best trees are considered.

- **Control forest fire:** Fire in forests sometimes occurs due to natural processes like lightning strikes or friction between trees during high-speed winds. Sometimes, intentional or unintentional human activities may also cause fire in forest. Precautions must be taken for such incidents like making fire lanes, spreading chemicals to control fire, clearing out dry leaves and trees, etc. There must be a trained staff of fire-fighters to control the fire.
- **Afforestation and Reforestation:** Afforestation is the process of planting more trees on land with few or no trees i.e. creating a new forest. Reforestation is the process of planting more trees in an existing forest with less number of trees due to forest fire or excessive cutting. These two methods will help restore the natural vegetation which is important for maintaining the ecological balance.

Brainy Fact

Russia has the largest number of trees in the world, estimated at 642 billion trees. Next is Canada with 318 billion trees, and Brazil with 302 billion trees.

Saving Environment using 5R's

With the rising population all over the world, we are constantly in the process of production and consumption of natural and man-made resources. This has led to generation of waste products of different types. The organic waste is decomposed on its own but the inorganic waste like plastic does not decompose naturally and accumulates for years. The modern waste management techniques using 5R's—Repurpose, Reduce, Reuse, Recycle and Refuse will definitely help in managing our waste sensibly, so that there is less damage to our environment.

Let us study what we need to do to follow 5R's in our daily practice of waste management:

Repurpose

It refers to finding a new use or function for something that was originally intended for a different purpose. It's about creatively finding ways to extend the lifecycle of an item rather than disposing of it.

- Transforming old clothing into cleaning rags.
- Using glass bottles as decorative vases.
- Repurposing wooden pallets into furniture.
- Turning old furniture into garden planters or using glass jars as storage containers.

Reduce

By reducing waste, we reduce the use of resources, so that there are less efforts for waste management.

- Avoid printing non-essential documents. If needed, print on both sides of the page.
- If something has to be bought in large quantities, then buy in bulk altogether to reduce packaging and transportation.
- Buy products that can do more than one thing.
- Buy reusable items rather than disposable ones.
- Carry your own reusable shopping bags to avoid using plastic bags.
- Reduce the use of single-use plastics, plastic packaging, and styrofoam cups.

Reuse

Reuse of the products will save the cost of making disposable products. This will help in saving more money which will work in favour of the country's economy and ultimately less of waste to manage.

- Second-hand stores should be opened in various locations, so that people can send their things like clothes, toys, utensils and other products which are of no use for them and others in need can reuse them.
- Give unwanted toys and books to NGOs and people in need.
- Use reusable packaging material for food and other items.

Recycle

Recycle is the most eco-friendly method of waste disposal. In this process, the waste material is reproduced to create another product which can be used for some other purposes.

- People should be encouraged to buy products that are made from recycled materials.
- Automobiles' parts, cans, construction material, etc. are all made of metals that can be recycled.
- Any plastic bottle or container for food storage must be recycled.

Refuse

In an environmental context, "refuse" means to actively choose not to use or accept something, especially items that are wasteful or harmful to the environment.

- Refusing single-use plastic bags by using reusable cloth bags instead, or refusing to buy products with excessive packaging.
- Refusing single-use plastics like straws and bags.
- Avoiding products with excessive packaging.
- Saying no to disposable utensils and opting for reusable ones.

Activities that are Damaging our Earth and Environment

Some of the human activities, which cause damage to the environment are over-exploitation of resources, pollution, deforestation, mining, destruction of natural habitats, construction, etc. Let us now discuss how some of these activities are damaging our earth and environment.

- **Over-exploitation:** This results when harvesting of resources exceeds their reproduction or replenishment. It means that when we exploit the species faster than the natural populations can recover, then it may result in extinction of the species, thus affecting directly or indirectly the ecological cycle and our environment. For example, removal of wild medicinal plants, excessive grazing of pastures by animals, destruction of forests, and water aquifers, overfishing and over hunting, results in over-exploitation of forests and natural habitats.
- **Mining:** Mines are dug below the earth's surface to get ores. The ores are then refined to extract the valuable elements, such as metals, gems, minerals, etc. Some of the environmental impacts of mining include erosion, formation of sinkholes, loss of biodiversity, and contamination of soil, groundwater and surface water by chemicals from the mining processes.
- **Deforestation:** It is the clearance of a forest or stand of trees where the land is converted to a non-forest use, such as agriculture and construction of houses. It results in loss of habitat for many plants and animals living in the forest. It may also lead to extinction of plant and animal species.
- **Pollution:** This word is derived from the Latin word "polluere" meaning "to soil" or "defile (contaminate)". Pollution is caused by pollutants, which may be solid, liquid, or gaseous in nature. Pollution is the effect of undesirable changes in our surroundings that have harmful effects on plants, animals, and human beings. Pollutants are produced due to human activity, which have a detrimental effect on our environment.

  For example, factories consume a lot of water and electricity and release harmful chemicals in air, land, and water, thus contaminating the atmosphere. Water pollution caused by factories and other industries can be the most serious problem. They also pollute the air through fossil fuel emissions. These emissions include carbon dioxide, methane, and nitrous oxide, which are harmful to living beings.

Pollutants are of two types:

Pollutants that can decompose	Pollutants that cannot decompose
Pollutants that break down into simpler, harmless substances naturally (by the action of moisture and bacteria) are called biodegradable pollutants.	Pollutants which cannot be broken down into simpler and harmless substances are called non-biodegradable pollutants. The harmful effect caused by these pollutants will be there for hundreds of years.
Examples: vegetable waste, sewage waste, paper, wood, cattle dung, agricultural waste from organic farms, etc.	Examples: plastics, insecticides, pesticides, chemicals like mercury or lead, aluminium, glass, etc.

Some of the other factors responsible for polluting the environment are as follows:

- Exhaust fumes released from vehicles pollutes the air.
- Excessive use of chemicals in agriculture (like insecticides and fertilisers) affect the alkalinity of the soil or the soil pH. It adversely affects the health of microorganisms and other organisms in the soil.
- Plastic waste like bottles, bags, etc., thrown on land and sea pollutes the water and destroys the flora and fauna.
- Dangerous gases (chlorofluorocarbons or CFCs, methane, carbon dioxide, etc.) released into the air.

The various types of pollution are summarised in Table.

Types of Pollution

Factors	Land Pollution	Water Pollution	Air Pollution
What it is?	• Damage to the land because of harmful substances is known as land pollution.	• Adding harmful substances and disease causing bacteria and other microorganisms to rivers, lakes, and oceans results in water pollution.	• Addition of harmful gases and particles in air results in air pollution.
What happens because of this pollution?	• Diseases, such as dysentery, cholera and typhoid • Less land is available for use of forests, farms or homes	• Diseases, such as dysentery, diarrhoea, jaundice, typhoid, etc. • Local earnings, like tourism, fishing etc. are adversely affected • Less drinking water	• Heart and breathing problems and cancers • Climate change
Why does it happen?	• Cutting down forests • Harmful pesticides and fertilisers • Mining and heavy construction • Release of sewage, toilet waste, waste from houses/factories, and chemical waste	• Throwing waste in water • Leakage from sewer lines • Release of waste water from houses, farms and factories • Accidental oil leakage from ships	• Burning of fuels • Smoke from traffic • Burning waste and remains of crops • Pesticides and fertilisers • Smoke from factories • Dust from construction
How to prevent it?	• Reduce waste • Segregate (separate) waste products • Plant trees • Adopt natural and organic farming methods • Use biodegradable items	• Do not throw waste into water bodies • Do not throw chemicals, medicines, oils, etc., in drains • Avoid using pesticides and fertilisers • Ensure proper treatment of sewage and factory waste • Use water wisely	• Use renewable sources of energy • Avoid polluting vehicles • Stop others from burning waste and left-over crops • Avoid pesticides and fertilisers which release harmful gases

Climate Change

Global warming refers to the increase in the average temperature of the Earth's atmosphere mainly due to greenhouse gases (carbon dioxide, CFC's) produced by a lot of human activities. It has resulted in melting of glaciers, rising sea level and intense heat waves all across the globe. It is one of the major environmental issues, as it creates an ecological imbalance and has become a reason for the extinction of many plant and animal species.

Main causes of global warming are:

- Excessive use of fossil fuels like coal, oil and natural gas produces greenhouse gases-like methane, nitrous oxide and mainly carbon dioxide which trap the sun's radiation within the atmosphere resulting in rise in global temperature. This is called green house effect.
- Trees absorb CO_2 from the atmosphere and release oxygen instead, so they work as air purifiers. Deforestation due to urbanisation and industrialisation has reduced the number of trees on the earth. This has resulted in the increase of carbon dioxide level in the atmosphere.
- Over-consumption of natural resources due to population explosion has also contributed to global warming.
- Increase in pollution is also responsible for the rise in global warming.

Greenhouse gases that occur both naturally and from human activities include water vapour, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and ozone (O_3). Other greenhouse gases have essentially no natural sources, but are the side products of industrial processes or manufactured for human purposes, such as cleaning agents, refrigerants, and electrical insulators. These include the fluorinated gases: chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs). This greenhouse effect causes snow to melt very fast. Carbon dioxide emissions into the atmosphere from burning oil, coal and gas for energy use is a serious problem as it is harmful to the environment. Carbon dioxide in the atmosphere has increased by 31% since pre-industrial times, causing more heat to be trapped in the lower atmosphere. As a result, there are frequent floods and changes in climate as well as damage to crops and animal life.

Harmful Radiation

You might be knowing that the atmosphere protects us from harmful radiation from the sun. This is done by a layer all around the earth, in the atmosphere, called the "Ozone Layer". It is made of a gas called 'Ozone'. This layer in the atmosphere protects us from the harmful radiation.

Cleaning chemicals, coolants in refrigerators and air conditioners, etc., release ozone depleting substances, such as chlorofluorocarbons in the atmosphere. These destroy the ozone in the atmosphere, making holes in the ozone layer. The harmful radiation comes in through these holes and causes increased incidence of health disorders, such as skin cancer.

Natural Disasters

Natural disasters include floods, earthquakes, landslides, storms, etc. Our actions in exploiting natural resources for building structures, such as large dams and buildings sometimes aggravates the impact of natural calamities and disasters.

Mining Activity

Mining is the process of extracting useful minerals from the earth's surface. It is estimated that two-thirds of the world's yearly mineral production is done by surface mining.

If we keep on extracting minerals from our natural resources, then it will create an ecological imbalance. So many country's government allows only a limited number of mining activities to be done that too under its supervision. Sometimes humans for their own profits indulge in illegal mining without realising the importance of preserving these natural resources. A lot of legal or illegal mining activities all across the globe are responsible for significant environmental damage:

- Acid mine drainage, which is the formation and movement of highly acidic water rich in heavy metals, contaminates the surrounding water bodies.
- Mining can deplete surface and groundwater supplies.
- To get the land for mining, the forest in that area is destroyed. This has a negative impact on the plants and animals living in that region.
- When the mining is over and that area is abandoned, then it creates wastage of land which is suitable neither for industrial use nor for agricultural purpose.

Saving the Environment

To save our environment, we need to educate people. Education is important, as it gives people the knowledge and skills that they need to perform. Educating people about the environment, through the environment and for the environment will enlighten them in utilising their knowledge and skills for saving the environment as responsible citizens.

- **Learning about the environment:** Learning about the environment focuses mainly on acquisition of knowledge and understanding of our surroundings and related issues.
- **Learning through the environment:** Learning through the environment refers to the processes of learning while being engaged with the environment inside and outside the classroom. It focuses on the learning process, such as observation, hands-on experience, learning-by-doing, problem-solving through an exposure to the environment and learning. The direct contact with the environment provides the relevant context for acquiring knowledge, skills, aesthetic appreciation, and practical experience to learning. Environment damage can be minimised by developing the skills and knowledge required for efficient resource utilisation, green processes and technologies and integrating these into our businesses and daily activities.
- **Learning for the environment:** Learning for the environment aims at the development of an informed response and responsibility towards the environment.

Brainy Fact

Since 1870, global sea levels have risen by about 8 inches due to global warming. Arctic is one of the worst places to be affected by global warming.

Actions for Saving the Environment

Some actions that you can take for yourself and encourage your friends, family and neighbours to take are:

Factors	Avoid	Prefer
Air pollution	Burning materials, such as burning wheat or rice straw in agricultural field	Using natural ventilation or fans in place of air conditioners
Energy use	Leaving electrical lights or appliances on, when not required	Using public transport buses and cycles (instead of cars), using solar or wind energy
Water pollution	Throwing waste in rivers and lakes	Using recycled water or water harvested through rains for watering garden plants
Waste	Using plastic bags	Segregating waste before throwing, so that the biodegradable waste can be harvested
Chemicals in food	Using chemical pesticides or fertilisers	Organic (natural and chemical free) food to promote organic farming
Forest Plants	Over-use of paper should be avoided	Reusing paper for making paper based products
Water	Over-use of water should be avoided	Reducing water use during bathing by using water filled in a bucket instead of shower

What is Sustainable Development?

Sustainable development was defined in the World Commission on Environment and Development 1987 Brundtland Report "Our Common Future" as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

"Sustainable development is the development that satisfies the needs of the present without compromising the capacity of future generations, guaranteeing the balance between economic growth, care for the environment, and social well-being".

The purpose of sustainable development is to keep a balance between the economic, environmental, and social needs. It requires the active participation of individuals, businesses, administrations, and countries around the world to find better ways of doing things so that the present generation can give back to nature, for our future generations to thrive. All the nations across the globe need to stand together to contribute in small actions to bring long-term sustainability of the environment for sustainable social and economic growth.

It will help companies with innovative technologies flourishing all across the globe, people will have better jobs, everyone will be able to afford nutritious foods without moving out of their native place, living in clean, healthy setup with proper sanitation facility, they will have quality and affordable education, and technical advancement to bring social and economical equality while keeping the environment safe.

Sustainable development includes the following:

- reducing excessive use of resources and enhancing resource conservation.
- recycling and reuse of waste materials.
- scientific management of renewable resources, especially bio-resources.
- planting more trees.
- using more environment friendly material or biodegradable material.
- green, grassy patches to be interspersed between concrete buildings.
- use of technologies, which are environmentally friendly and based on efficient use of resources.

Sustainable Development Goals- Agenda 2030

The Sustainable Development Goals also known as the Global Goals, are a universal approach for improving our world. These 17 interconnected universal goals approved by the United Nations General Assembly in 2015 and are expected to be achieved by the year 2030. They serve as a blueprint for creating a better and more sustainable future for all.

These goals will help all the nations across the world to design their national development plans for the next 15 years in such a way that it should end poverty and hunger, bring peace and justice and sustain our natural resources with minimum climate changes, food, and agriculture with less damage to mother Earth.

The SDGs have been framed with the objective of addressing vital issues facing businesses, governments, and society. These include poverty, gender equality, water use, energy, climate change, and biodiversity.

Countries are now establishing policies and regulations that will promote sustainable systems needed in all economic sectors to provide a secure, affordable, and sustainable economy. The core skills identified as necessary for the green worker include environmental awareness and willingness to learn about sustainable development as well as general learning and decision-making ability.

Green Growth

The concept of green growth aims at achieving economic growth that is socially inclusive and environmentally sustainable. The Ministry of Environment, Forest, and Climate Change, Government of India recognized green growth in its vision, wherein 'poverty eradication' along with green growth is to be seen as the focal point for green economy. The Finance Commission of India articulated green growth as involving "rethinking growth strategies with regard to their impacts on environmental sustainability and the environmental resources available to poor and vulnerable groups." The extent to which its economy will "grow green" will depend on its ability to reduce the quantity of resources required over time to support economic growth that leads to enhancement of social equity and job creation. Green growth could play an important role in balancing these priorities. To ensure sustainable development, any activity that is expected to bring about economic growth must also consider its environmental impacts so that it is more consistent with long term growth and development.

This means vehicles on the road which leads to traffic congestion, waste of time for all the commuters, and a great load of particulate matter and carbon monoxide from the exhaust of vehicles should be slowly replaced with an efficient public transport system.

Green Economy

The term "Green Economy" was first coined in a 1989 report for the Government of the United Kingdom by a group of leading environmental economists, entitled "Blueprint for a Green Economy". There is no internationally agreed definition of a green economy but many countries have realised that the country's economy and the balance in the environment go hand in hand. The United Nations Environment Programme (UNEP) has defined the green economy as "one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. It is low carbon, resource efficient and socially inclusive".

It is an effort of the whole world to create a healthy planet by using alternative ways of growth and development that improve quality of life of people through sustainable development. It also means healthy clean air to breathe, pure water to drink and wholesome food to eat for all without exhausting our present natural resources and saving it for the future generations to come.

Characteristics of Green Economy

Environmentally sustainable development has become the main goal of all the countries across the globe since the UN Conference on Environment and Development (UNCED) in 1992. It emphasises that the Green Economy provides prosperity for all within the ecological limits of the planet. It focuses on:

- Well-being and prosperity for all people by providing good education, decent livelihoods, and jobs.
- Supporting human rights and social equity especially the rights of under-privileged and minorities.
- Nurturing the geographical boundaries to safeguard, restore and invest in nature. It protects the biodiversity and natural ecosystems.
- Creating prosperity within planetary boundaries for sustainable production and consumption. It provides economical growth by aligning prices, subsidies, and incentives with true costs to society.
- Good governance by adapting sound science and economics along with local knowledge. It prioritises public participation, informed consent, transparency, and accountability.

Skill Development for Green Economy

The key challenges for India are to expand access to food, energy, water, and other essential goods and services to its growing population. It needs to work towards the objective of alleviating poverty and catalysing sustainable development. The development of skills for green jobs is crucial to ensuring an efficient transition from unsustainable to a green economy by matching supply and demand for skills. A green job can be found in business, non-profit organisations, government, or education.

Some green jobs may have specific requirements for green skills, such as an organic farmer needs to have knowledge and skills for growing organically certified crops. Solar technicians or engineers should possess the knowledge and skills for design, installation and maintenance of solar panels and appliances. Other green jobs may not necessarily require specific skills. For example, a graphic designer or a cashier working for a green company or organisation will be contributing to the development of green growth and economy.

Components of Green Economy

There are six basic components of a Green Economy:

- **Renewable Energy:** Energy produced by renewable sources like wind, sun, water, etc. is called renewable energy. Using these as the alternate sources of energy will help reduce the impact on the environment.
- **Green Buildings:** Buildings which causes minimum destruction to the environment during its construction and use renewable energy with proper waste management are called green buildings.
- **Green Transport:** It supports a well-planned transportation system with minimum damage to the forest and environment. It also promotes efficient use of fuel that produces minimum greenhouse gases and also uses alternate sources of fuel like CNG, battery, etc.
- **Water Management:** It is to reduce the wastage of water and replenish the groundwater level by adopting rainwater harvesting. Using rainwater for agriculture, wastewater for recycling, etc. reduce scarcity of water.
- **Waste Management:** It is managing the waste by adopting 5R's—Repurpose, Refuse, Reduce, Reuse and Recycle for minimum environmental degradation.
- **Land Management:** It is judicious use of land resources like soil, forests, farms, roads, etc. without causing much damage to the environment.

Importance of Green Economy

The Green Economy is an innovative method of improving the country's economy with minimum environmental degradation. Its major benefits are:

Environmental Benefits

Environmental benefits of green economy are:

- It helps in decreasing environmental pollution, which is a big effort to protect the environment without degrading the quality of soil, water and air.
- It helps in reducing the negative impacts of greenhouse gases by adopting technologies and products that minimise carbon emissions. This will work in reducing global warming.
- Less damage to our forests and biodiversity will help in survival of rare species on the earth.
- It helps in eco-friendly, sustainable management of natural resources.
- It brings conscious inclination towards the alternate sources of energy.

Economic Benefits

Economic benefits of green economy are:

- It brings economic growth through the establishment of new markets for biofuels and other renewable energy resources.
- This will develop new markets with specialised, trained and skilled manpower.
- Creation of more eco-friendly industries will bring more employment, security and stability in the society.
- Agriculture industry will also believe in promoting the growing of pesticides and chemical free crops.

Social Benefits

Social benefits of green economy are:

- It improves the health and well-being of the society which increase the productivity of the country and reduce the costs of health care.
- It improves livelihood status and poverty rate.
- It reduces environment related health problems.

Green Skills

The specialised skills which are important for building or developing Sustainable Green Economy are called Green Skills. Learning green skills is one of the major ways to enhance knowledge, abilities, values, and attitudes to develop and support organisations that focus on improving environmental conditions.

With scientists all across the globe repeatedly warning about how our environment is being seriously damaged by our actions, it has become necessary for us to learn the importance of implementing Green Skills in all possible ways.

The government of India launched the Green Skills Development Programme (GSDP) in India in the year 2017. This was started by the Ministry of Environment, Forest and Climate Change MoEFCC in partnership with National Skill Development Agency (NSDA). It aims to develop green skilled workers having technical knowledge and commitment to sustainable development. It will help in attainment of Nationally Determined Contributions (NDCs), Sustainable Development Goals (SDGs), National Biodiversity Targets (NBTs) and Waste Management Rules 2016.

Some of the areas in which green skills contribute to the sustainable development are as follows:

- using renewable energy (example, using solar power and wind energy)
- water and waste management
- rain water harvesting
- conserving energy
- reducing pollution

Green skill is crucial for making a transition from energy and emissions-intensive economy to cleaner and greener production and service. It also prepares people for green jobs that contribute to preserving or restoring the quality of the environment, while improving human well-being and social equity. Many technologies have been developed to make use of solar energy, such as solar lights, solar cookers, solar water heaters, etc. The installation of the solar panels and appliances requires engineers and technicians.

Environmental change can be seen as an important factor that affects labour demand and skills supply across all sectors, such as Automotive, Retail, Electronics, Power, Construction, etc., which impacts the economy. Green Skills thus, are the skills that aim to balance economic development with environmental conservation so that the needs of the society, economy and environment are efficiently met, with minimum damage to the environment.

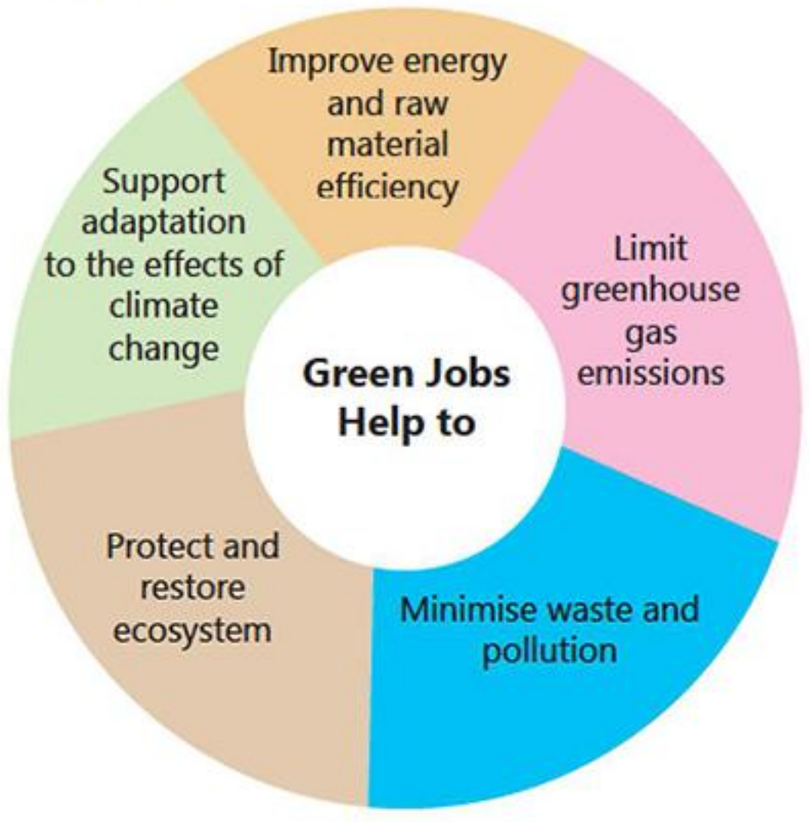
Knowledge and skills needed for managing resources and supporting efficiency.

Purpose	Knowledge and skills needed for green economy
Manage natural resources	• To assess environmental impact • To design and adopt technologies that help in reducing the consumption of natural resources • To understand legislation and guidelines for sustainable utilisation of natural resources
Support climate resilience	• To develop models for interpreting climate change projections • To develop risk management strategies for future resource availability • To adopt technologies that improve resilience
Support resource efficiency	• To develop resource efficient business models • To develop and adopt technologies that maximises resource utilisation and reduces waste
Support low carbon industry	• To develop technologies that promote renewable energy sources (wind, solar, and water) • To design and adopt technologies and products that minimises carbon emissions

Green Jobs

People possessing Green Skills are getting jobs in the fields of agriculture, manufacturing, Research and Development (R&D), administrative, and service activities that are aimed at sustaining and protecting the environment. These jobs are called Green Jobs. People with green jobs ensure that resources in an economy are allocated in a fair and an equitable manner. These jobs help in:

- Ensuring judicious consumption of energy and raw materials.
- Reducing the greenhouse gas emissions especially that of carbon dioxide.
- Minimising pollution at all levels.
- Putting in place proper waste management systems that minimise waste generation and contamination of the environment.
- Protecting and restoring our ecosystems.
- Positively impacting our country's green economy.
- Producing eco-friendly goods or services.



Some of the sectors, which have the potential for green jobs are as follows:

Sector	Areas/ Field	Green Jobs
Agriculture	• Organic farming • Watershed management • Rain water harvesting	• Water quality technician • Rain water harvesting professionals and technician • Solar pump technician • Greenhouse or polyhouse professionals and technicians
Construction	• Planning, design and manufacturing of energy efficient lighting appliances and equipment • Increasing efficiency of existing buildings through energy audits • Planning, design, and construction of green buildings • Green plumbing, using sensor based equipment	• Green builders • Green design professionals • Green workers
Energy	• Research, construction, and monitoring of power plant, including plant efficiency and carbon sequestration measures. • Increased power plant efficiency	• Solar Cell Technicians and Engineers • Wind energy professionals • Wind energy workers • Biofuel professionals • Wave energy producers
Forestry	• Reforestation and afforestation projects • Agroforestry and vertical farming for better utilisation of natural resources	• Natural scientists
Manufacturing	• Pollution control • Energy efficiency • Recycling waste materials	• Recyclers
Retail	• Greener products and specifically targeted green stores	• Green salesperson • Accountants • Cashiers • Sales associates
Automotive and Transport	• Research and design on more fuel efficient vehicles and on public transport systems • Manufacture of alternatively fuelled vehicles	• Clean car engineers
Tourism and Hospitality	• Eco-friendly practices, such as centralized lighting and air conditioning systems for saving electricity • Eco-tour guides	• Eco-tour guides • Green tour guides
Education	• Research and development activities for promoting green growth and economy • Teaching environmental education • Research and development in conservation of natural resources	• Teachers teaching environmental education • Green scientist • Conservation biologists

Reboot

1. In which year was the Green Skills Development Programme (GSDP) launched in India?

2. Name any three components of Green Economy.

3. What do you mean by green jobs?

4. What do you mean by soil pollution?

Green Projects in India

The environment friendly projects that aim to reduce pollution, fossil fuel consumption or some other positive effects on the environment are called Green Projects. India is making rapid progress in various areas of clean and green technologies. Many profit and non-profit organisations and startups have joined hands with the Government of India to help the country progress in terms of promoting and protecting the environment. Some of the Green Projects of India are:

- **Digital Green:** It is a multimedia solution for rural education, Digital Green is a not-for-profit organisation partnered with local public, private and civil society organizations to build innovative platforms to enable rural communities to create and share knowledge on improved agricultural practices, livelihoods, health, and nutrition using locally produced videos.
- **Solid Waste Management by 'Swachh Cooperative':** This green project is wholly owned by waste pickers. The Cooperative has members who are engaged in door step collection of waste in Pune. This integrates informal waste pickers into Pune city's Solid Waste Management System.
- **Bio-toilet by 'Green Solution Foundation':** GSF (Green Solution Foundation) has created a bio-toilet solution for hygienic sanitation in villages and slums that lacked sewage systems.
- **Feeding India:** This green project takes leftover food to the poor. This is done by helping the needy get access to excess cooked food from restaurants and caterers.
- **HelpUsGreen:** This green project recycles waste flowers. Kanpur-based HelpUsGreen makes 'flowercycled' natural and certified organic products from flowers. They collect flower waste from places of worship and even the Ganges river and repurpose it into vermicompost, incense sticks and bathing bars through proprietary methods.
- **SayTrees:** This green project conducts tree plantation drives. SayTrees is a professionally-run group of people that is determined to protect the environment by sensitising others towards the importance of environment conservation.
- **Fourth Partner Energy:** This green project makes solar energy accessible. It was founded in 2010 by Vivek Subramanian, Saif Dhorajiwala and Vikas Saluguti. Fourth Partner Energy (4PEL) focuses on financing and building rooftop solar projects for commercial, industrial, and residential clients. It recently raised $125 million in equity funding from Norwegian investment fund Norfund and existing shareholder, The Rise Fund.

At a Glance

- Environment refers to our surrounding consisting of physical, chemical, and biological elements that maintain a balance between the living and non-living components.
- An Ecosystem is defined as a community where living and non-living organisms interact with each other and their surrounding environment to form a balanced system.
- The resources that exist without any intervention of humans and are present in abundance in our surroundings are called natural resources.
- Earthworms are considered as a farmer's best friend. By introducing more earthworms, we can increase the fertility of soil.
- The modern waste management techniques using 5R's—Repurpose, Refuse, Reduce, Reuse and Recycle will definitely help in managing our waste sensibly.
- Global warming refers to the increase in the average temperature of the earth mainly due to greenhouse gases (mainly carbon dioxide) produced by a lot of human activities.
- Promoting well-being and prosperity for all people by providing good education, decent livelihoods and jobs is one of the characteristics of Green Economy.
- There are six basic components of green economy are: Renewable Energy, Green Buildings, Green Transport, Water Management, Waste Management and Land Management.
- The specialised skills which are important for developing Sustainable Green Economy are called Green Skills.
- Green Jobs protect and restore our ecosystems.
- The environmentally friendly projects that aim to reduce pollution, fossil fuel consumption or some other positive effects on the environment are called Green Projects.

Exercise

Solved Questions

SECTION A (Objective Type Questions)

Quiz

A. Tick (✓) the correct option.

1. From which word the environment word is derived?

   a. French word "Environia" ○ b. Latin word "Environ" ○

   c. Arabic word "Envior" ○ d. Sanskrit word "Envior" ○

2. Which of the following is Abiotic?

   a. Living components of the ecosystem ○ b. Non-living components of the ecosystem ○

   c. Living and Non-living both ○ d. Only animals of the ecosystem ○

3. Which of the following is a type of natural resource?

   a. Renewable ○ b. Non Renewable ○

   c. Exhaustible ○ d. All of these ○

4. Which of the following is used to conserve our natural resources?

a. Furniture Conservation ○ b. Water Conservation ○

c. Money Conservation ○ d. Clothes Conservation ○

5. The term "Green economy" was first coined by which of the following?

a. Government of India ○ b. Government of United Kingdom ○

c. Government of America ○ d. Government of China ○

6. Since when Environmentally Sustainable development has become the main goal of all the countries across the globe?

a. All Nations Summit in 2000 ○

b. All Nations Conference in 1998 ○

c. America Conference in 1998 ○

d. UN Conference on Environment and Development (UNCED) in 1992 ○

7. Which of the following is supported by Waste Management?

a. Disposal of waste ○

b. Too much waste generated needs to be managed ○

c. Reduce, Reuse, Repurpose, Refuse and Recycle ○

d. Proper collection of waste of all types in one place ○

8. What does Fourth Partner Energy, which is one of the famous Green Projects of India, focuses?

a. To make solar energy accessible ○

b. To make bio-gas accessible ○

c. To make wind energy accessible ○

d. To make nuclear power accessible ○

B. State whether these statements are true or false:

1. Rainwater harvesting is an example of water conservation. .....
2. Recycle and Refuse cannot be applied to water conservation. .....
3. Air is an example of exhaustible resource. .....
4. We need to conserve our natural resources to maintain environmental balance. .....

C. Fill in the blanks.

1. ..... can be used as an alternate source of fuel.
2. Our body is made up of ..... of water.
3. Planting more trees on land with few or no trees is called ..... .
4. Pollutants that can break into simpler substances naturally are called ..... .

SECTION B (Subjective Type Questions)

A. Short answer type questions:

1. List the reasons for soil loss and its fertility.

Ans.
- Deforestation.
- Use of chemical pesticides.

- Overuse of land.
- Making dams and doing mining activities.

2. Why is excess salt not good for soil?

Ans. It affects soil fertility and reduces the absorption of water by plants.

3. Name any four alternate sources of energy.

Ans.
- Wind Energy.
- Geothermal Energy.
- Solar Energy.
- Nuclear Energy.

4. What is Clear Cutting method in controlled deforestation?

Ans. If the same types of trees are available over a large area, then trees of the same age group can be cut down in a selected area and then marked for re-plantation.

5. How The United Nations Environment Programme (UNEP) has defined "Green Economy"?

Ans. The United Nations Environment Programme (UNEP) has defined the green economy as "one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. It is low carbon, resource efficient, and socially inclusive".

6. What are the sources of pollution? [NCERT]

Ans. Poisonous gases emitted from factories & vehicles, chemicals & garbage dumped in the waterbodies, excessive sound of vehicles, etc. Noise pollution is caused due to the sound generated by Industrial and Constructional activities, factory equipment, generators, electric saws, drills and other machineries.

7. Write any three actions which you can take to conserve energy. [NCERT]

Ans.
- Use alternative sources of energy.
- Implement government policies in order to safeguard our natural resources.
- Recycle and reuse elements and products.

8. Name any three components of the Green Economy.

Ans. The three components of the green economy are:
- Renewable Energy.
- Green Buildings.
- Green Transport.

9. What is the Green Skills Development Programme?

Ans. The government of India launched the Green Skills Development Programme (GSDP) in India in the year 2017. This was started by the Ministry of Environment, Forest and Climate Change (MoEFCC) in partnership with National Skill Development Agency (NSDA). It aims to develop green skilled workers having technical knowledge and commitment to sustainable development.

10. Define Green jobs? Give Example.

Ans. People possessing Green Skills are getting jobs in the fields of agriculture, manufacturing, research and development, administrative, and service activities that are aimed at sustaining and protecting the environment. These jobs are called Green Jobs.

B. Long answer type questions:

1. Explain two types of environment.

Ans.
- **Natural Environment:** When all living and non-living elements occur naturally in our surroundings and affect life in its natural ways by encompassing interaction of all living species and natural resources, it forms our natural environment. Plants and animals living on land, in air, or water form our natural environment. It may be claimed as Abiotic and Biotic.
- **Man-Made Environment:** It is the environment created by humans to create an atmosphere comfortable for him to interact and adjust to the natural environment. For example, permanent human settlements like villages, towns, cities, transport and communication facilities, factories, dams, etc.

2. What are the main causes of Global Warming?

Ans. The main causes of Global warming are as follows:

- Excessive use of fossil fuels like coal, oil and natural gas produces greenhouse gases-like methane, nitrous oxide and mainly carbon dioxide which trap the sun's radiation within the atmosphere resulting in rise in global temperature.
- Trees absorb CO_2 from the atmosphere and release oxygen instead, so they work as air purifiers. Deforestation due to urbanisation and industrialisation has reduced the number of trees on the earth. This has resulted in the increase of carbon dioxide level in the atmosphere.
- Overconsumption of natural resources due to population explosion has also contributed to global warming.
- Increase in pollution is also responsible for the rise in global warming.

3. How mining activities all across the globe are responsible for significant environmental damage?

Ans. Mining activities worldwide contribute to significant environmental damage through several activities:

- Acid mine drainage, which is the formation and movement of highly acidic water rich in heavy metals, contaminates the surrounding water bodies.
- Mining can deplete surface and groundwater supplies.
- To get the land for mining, the forest in that area is destroyed. This has a negative impact on the plants and animals living in that region.
- When the mining is over and that area is abandoned, then it creates wastage of land which is suitable neither for industrial use nor for agricultural purpose.

4. Give three important characteristics of the Green Economy.

Ans. The three important characteristics of the Green Economy:

- Well-being and prosperity for all people by providing good education, decent livelihoods and jobs.
- Supporting human rights and social equity especially the rights of under-privileged and minorities.
- Nurturing the geographical boundaries to safeguard, restore and invest in nature. It protects the biodiversity and natural ecosystems.

5. Give two necessary reasons for adapting to the Green Economy.

Ans. Adapting to the Green Economy is necessary for two key reasons:

- It is an effort of the whole world to create a healthy planet by using alternative ways of growth and development that improves quality of life of people through sustainable development.
- It also means healthy clean air to breathe, pure water to drink and wholesome food to eat for all without exhausting our present natural resources and saving it for the future generations to come.

6. Define the Green Projects in India. Give examples.

Ans. The environmentally friendly projects that aim to reduce pollution, reduce fossil fuel consumption or some other positive effects on the environment are called Green Projects. For example:

- **Digital Green:** It is a multimedia solution for rural education.
- **Solid Waste Management by 'Swachh Cooperative':** This green project is wholly owned by waste pickers.
- **Bio Toilet by 'Green Solution Foundation':** it has created a bio-toilet solution for hygienic sanitation in villages and slums that lacked sewage systems.

7. Give any four environmental benefits of the Green Economy.

Ans. The four environmental benefits of the Green Economy are:

- It helps in decreasing environmental pollution, which is a big effort to protect the environment without degrading the quality of soil, water and air.
- It helps in reducing the negative impacts of greenhouse gases by adopting technologies and products that minimise carbon emissions. This will work in reducing global warming.
- Less damage to our forests and biodiversity will help in survival of rare species on the earth.
- It helps in eco-friendly sustainable management of natural resources.

8. Give four advantages of getting Green Jobs.

Ans. Some of the advantages of getting Green Jobs are:

- Ensuring judicious consumption of energy and raw materials.
- Reducing the greenhouse gas emissions especially that of carbon dioxide.
- Minimising pollution at all levels.
- Putting in place proper waste management systems that minimise waste generation and contamination of the environment.

C. Competency-based/Application-based questions:

#Creativity & Innovativeness

1. Make a list of your efforts to prevent global warming.

Ans.
- Tree Plantation.
- Promote use of CNG in vehicles.
- Car Pooling.
- Proper disposal of domestic waste.

2. You have a gardner coming at your place on weekends to take care of plants in your garden. How can you help him implement green skills?

Ans.
- Using green manure instead of chemical fertilisers and pesticides.
- Waste management by recycling dead plants and leaves.
- Less wastage of water while watering them.
- Planting those plants that absorb more carbon-di-oxide in the atmosphere.

3. Can you suggest some points that an architect must keep in mind at the time of designing a Green Building.

Ans. When designing a green building, an architect should consider several key points to ensure sustainability and energy efficiency. Here are some important factors to keep in mind:

- Proper waste management.
- Water savings.
- Renewable Energy.
- Solar panel installation.
- Indoor environment quality.

Unsolved Questions

SECTION A (Objective Type Questions)

Quiz

A. Tick (✓) the correct option.

1. What can be defined as an economy with a vision of growth and development for mankind while reducing environmental risks or ecological imbalance?

a. Green Economy ○ b. Market Economy ○

c. Mixed Economy ○ d. None of these ○

2. It is the effect of undesirable changes in our surroundings that have harmful effects on plants, animals, and human beings.

a. Pollution ○ b. Deforestation ○

c. Industrialisation ○ d. Mining ○

3. The Finance commission of India articulated it as involving "rethinking growth strategies on environmental sustainability and the enviornmental resources available to the poor."

a. Green Growth ◯ b. Green Skills ◯

c. Green Economy ◯ d. Green Jobs ◯

4. What is the process of digging the earth for the extraction of ores called?

a. Industrialisation ◯ b. Mining ◯

c. Drilling ◯ d. None of these ◯

5. Which of the following is the forest resource?

a. Agricultural Land ◯ b. Gums and spices ◯

c. Lakes and oceans ◯ d. Sulphur ◯

6. Some non-renewable resources come from living things such as fossil fuels. They can be called as. ..... resources.

a. Organic Resources ◯ b. Inorganic Resources ◯

c. Organic non-renewable Resources ◯ d. None of these ◯

B. Fill in the blanks.

1. A/An ..... is a community where living and non-living things interact with each other and their surrounding environment to form a balanced system.
2. Since 1870, global sea levels have risen by about ..... inches due to global warming.
3. People should be encouraged to buy products that are made from ..... materials.
4. ..... used in agriculture causes soil erosion.
5. Marine and freshwater are examples of ..... ecosystem.

C. State whether these statements are true or false:

1. Earthworms are considered as the enemies of farmers. .....
2. We should not give unwanted toys and books to NGOs and people in need. .....
3. We should carry our own reusable shopping bags to avoid using plastic bags. .....
4. The modern waste management techniques uses 5R's. .....
5. Afforestation will not help restore natural vegetation. .....
6. The Green Economy does not promote social factors. .....
7. Using a solar water heater is a Green Skill. .....
8. Taking care of animals in a zoo is a Green Job. .....
9. Decomposing your garden leaves on your own by reuse is a waste of time. .....
10. Mining can deplete surface and groundwater supplies. .....

SECTION B (Subjective Type Questions)

A. Short answer type questions:

1. How can we protect our stream banks from soil erosion?
2. Name any two greenhouse gases.

3. What do you mean by Contour Ploughing?
4. What is Global Warming?
5. What do you mean by Renewable Resources? Give Examples.
6. Give one important reason to launch the Green Skills Development Programme.
7. Give three areas where Green Skills are needed.
8. How can we help in saving the environment by using Green Transport?
9. What do you understand by the term Ecosystem?
10. Make a list of the activities you will do to prevent soil erosion in your locality.
11. Make a list of alternate sources of energy we should use to save our environment.
12. Describe any three methods of water conservation. [NCERT]

B. Long answer type questions:

1. Explain some of the factors responsible for Environmental Imbalance.
2. Explain some of the ways to conserve food to avoid wastage.
3. Explain the use of 5R's in saving the environment.
4. What are the main causes of soil pollution?
5. Explain the biotic and abiotic components of an ecosystem.
6. How will green jobs help in saving the environment?
7. Explain this Green Project: Fourth Partner Energy
8. Explain any three social benefits of the Green Economy.
9. Define:
   a. Salinity Management
   b. No-Till Farming
   c. Crop Rotation
10. Why is it important to promote Green Growth?

C. Competency-based/Application-based questions:

#Creativity & Innovativeness

1. In a nearby construction site you saw a labourer's family using leftover woods as fuel for cooking food. Suggest them some environment friendly fuels.
2. On last day of your class before the starting of summer holidays, you saw some unwanted books and material lying here and there. How do you wish to dispose of them following green skills?

Lab Activity

#Environmental Awareness

1. What steps will you take to conserve the plants in your society?
2. Design a poster on Save Water. Write a slogan and take a print out on A3 size sheets. Place it on the gates of your housing society.

Class Activity

#Collaboration & Teamwork

1. Discuss in groups Hazards of Deteriorating environment, factors affecting same and what could be the probable solutions. [CBSE Handbook]
2. Activity-Factors influencing the environment [NCERT]

   Materials required: Pen and Notebook

   Procedure:
   - Form groups of three students.
   - Based on what you learnt about the environment and how different things or actions are effecting the environment, make a list of all factors (things or actions) that affect the environment.
   - Think about all the articles you use daily that are made from plastic and answer the following questions
     a. How plastic is made?
     b. What are those plastic articles you usually use?
     c. What effects does plastic have on our environment?
     d. How can you reduce the amount of plastic you use?
     e. What happens to plastic when you throw it away?
   - Discuss these factors in detail. One volunteer group explains their list to the rest of the class who give feedback.
3. Activity-Conserving natural resources. [NCERT]

   Material required: Pen, notebook, chart paper, colours, crayons etc.

   Procedure:
   - Form a group with four students in each group.
   - Make a list of all the energy or natural resources you use in a day, such as petrol or diesel for coming to school in a bus, electricity for light, etc. Then make a list of how you can reduce the amount of resources in each step.
   - Make a poster on 'Conserving the Environment'. Write short note on the following topics:
     a. Rain water harvesting
     b. Home composting
     c. Garden on terrace
     d. Organic gardening
     e. Drip irrigation

Answers

Exercise (Section A)

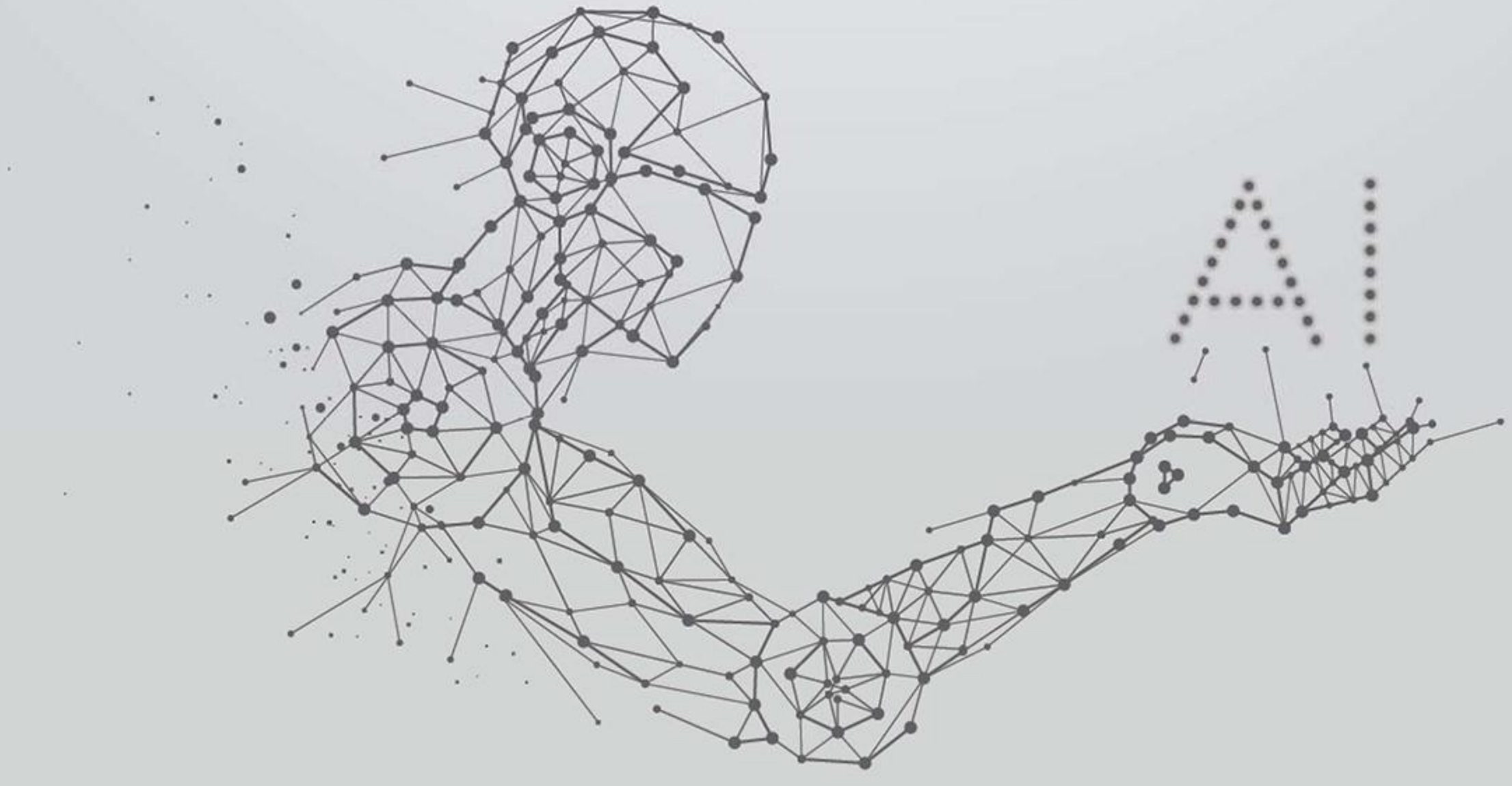
A. 1. a. 2. b 3. d 4. b 5. b 6. d 7. c 8. a

B. 1. True 2. False 3. False 4. True

C. 1. CNG 2. 70% 3. afforestation 4. biodegradable pollutants

PART-B

SUBJECT SPECIFIC SKILLS



UNIT-1

AI REFLECTION, PROJECT CYCLE AND ETHICS

Learning Outcomes

- What is Intelligence?
- Types of AI
- AI Around Us
- World Famous AI Machines
- AI in India
- Domains of AI
- Advantages of AI
- AI Project Cycle Framework
- Identifying the Stakeholders
- Problem Statement Template
- Ethical Issue Related to Problem Selection
- Data Exploration
- What is Evaluation?
- AI Project Cycle Mapping Template
- Artificial Intelligence
- How do Machines Become Intelligent?
- What is Not AI?
- Importance of AI
- Human-Machine Interaction
- Applications of AI in Real-Life
- Disadvantages of AI
- Problem Scoping and Setting Goals for an AI Project
- 4Ws Problem Canvas
- Iterative Nature of Problem Scoping
- Data Acquisition
- What is Modelling?
- What is Deployment?
- AI Ethics

Since ancient times, humans have tried to be better than others and moved forward with the creation of tools that aided them to stay ahead of every other living being. In an attempt to make life easier, humans tried to make machines intelligent and smarter. These days we have machines that can think and respond in ways similar to human being. This is how the concept of smart machines came into existence. In this chapter, we will explore how that change happened and how we came so far.

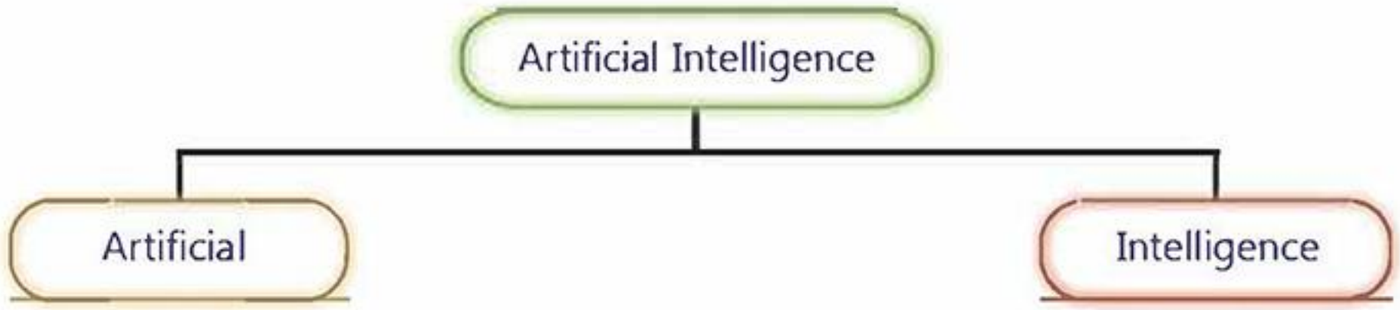
What is Intelligence?

Intelligence is the ability to learn from experience, recognise problems and solve problems. According to **Sternberg**—*"Intelligence is the capacity to learn from experience, using metacognitive processes to enhance learning, and the ability to adapt to the surrounding environment."*

Intelligence is the capacity to learn and behave adaptively. It can be defined as a person's ability to think and to learn. For example, students are considered intelligent if they understand the subject content and are able to score above-average grades.

Artificial Intelligence

Artificial Intelligence (AI) is a branch of computer science that simulate human intelligence into machines, especially in computer systems, so that they can think and perform actions similar to humans. The main aim of AI is to develop machines with intelligence like humans and having qualities like perception [the acquisition of information and rules for using the information], reasoning [using rules to reach the approximate or definite conclusions], and learning [self-corrections]. The term Artificial Intelligence is made up of two words: Artificial and Intelligence.



Artificial means "human-made" and Intelligence means "ability to think and make decisions". In simple words, Artificial refers to the things made by humans and Intelligence refers to the ability of people to think and learn from their past experiences.

Artificial Intelligence covers a wide range of systems and applications that have the ability to think and act like humans. It is used for creating machines with programmed algorithms which can take decisions like humans do. AI has made a greater impact on humanity than any other innovation till date.

Brainy Fact

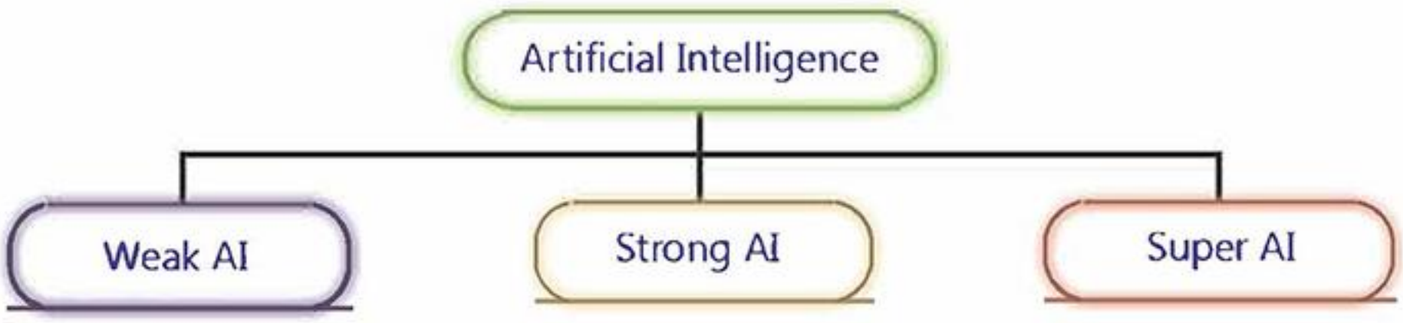
In 1956, John McCarthy first coined the term "Artificial Intelligence" and defined it as the science and engineering of making intelligent machines. Later in 2006, he was referred to as the "Father of Artificial Intelligence".

Types of AI

AI has already become an integral part of our daily life, therefore, it's important to understand what AI can actually do. In fact, AI is a broad term which includes Machine Learning, Big Data, and Natural Language Processing (NLP) as its subsets. These subsets can also be classified by the level of intelligence.

AI can be classified into three categories:

- Weak AI
- Strong AI
- Super AI



Let us learn about them in detail.

Weak AI

It is also known as Narrow AI. It is the most common type of AI that we can see and use all around us. Characteristics of this AI are as follows:

- It performs dedicated tasks with intelligence.
- It cannot perform beyond its capabilities. It is trained to perform a specific task. It fails in unpredictable situations.
- Apple's Siri is a good example of Weak AI systems. It is a digital virtual assistant that operates within a predefined limited range of operations.
- Even IBM's Watson Supercomputer comes under the category of weak AI. It is an expert system that combines machine learning and natural language processing.
- Some other examples include self-driven cars, image processing, e-commerce websites using chatbots, AI system playing chess, etc.

Strong AI

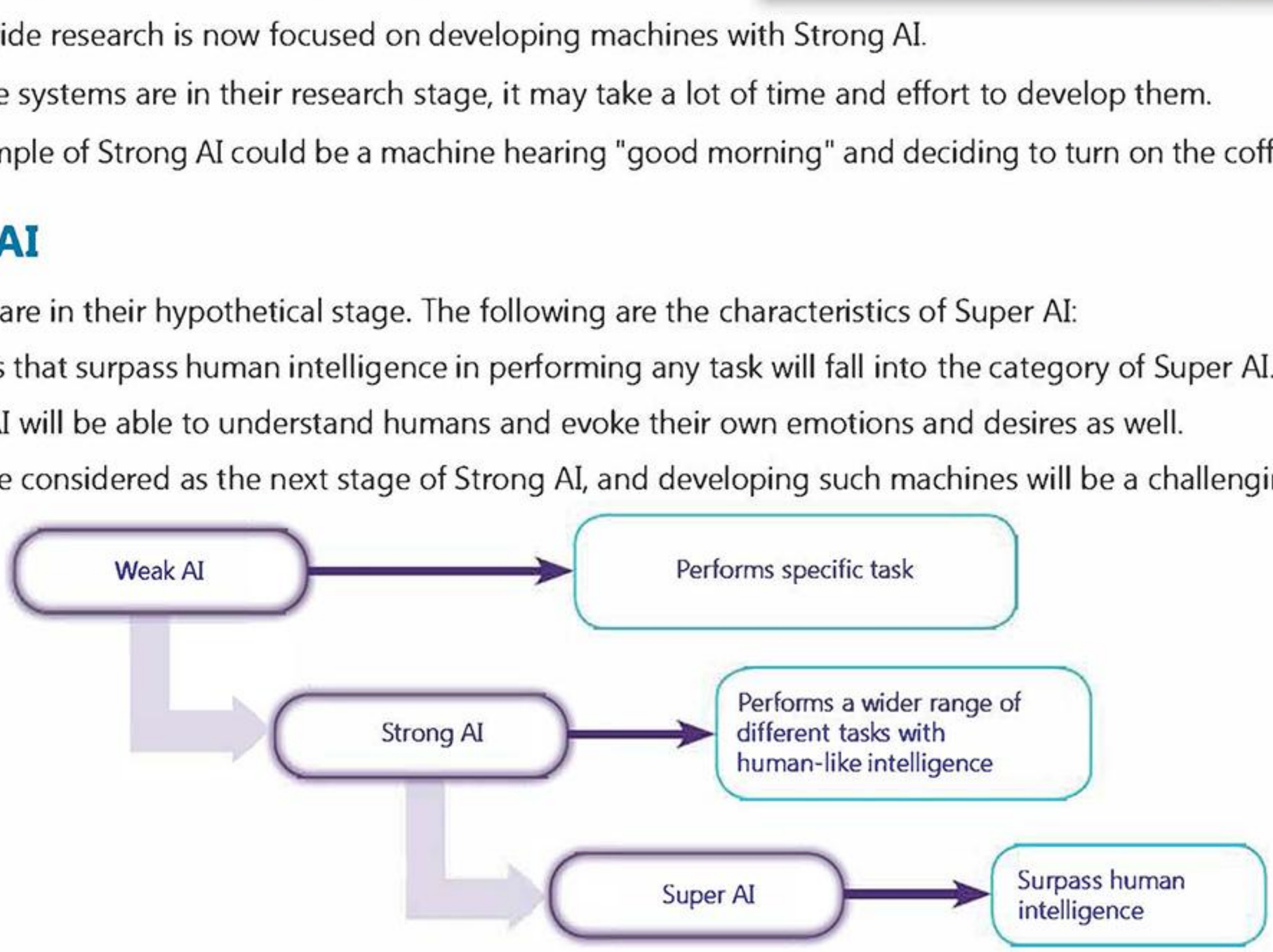
It is also termed as General AI. Machines with the following characteristics will fall into this category:

- Machines that would perform a wider range of different tasks with intelligence similiar to that of humans.
- It is a step ahead of Weak AI by including problem-solving, learning, and development.
- At present, we have not developed any such machines.
- Worldwide research is now focused on developing machines with Strong AI.
- As these systems are in their research stage, it may take a lot of time and effort to develop them.
- An example of Strong AI could be a machine hearing "good morning" and deciding to turn on the coffee maker.

Super AI

Super AIs are in their hypothetical stage. The following are the characteristics of Super AI:

- Systems that surpass human intelligence in performing any task will fall into the category of Super AI.
- Super AI will be able to understand humans and evoke their own emotions and desires as well.
- It can be considered as the next stage of Strong AI, and developing such machines will be a challenging task.



Ai Task

#Problem Solving & Logical Reasoning

1. Which movies have you seen about artificial intelligence?

2. How intelligent will artificial intelligence become by 2030, any guess?

3. At present, in what activities are computers better than humans?

How do Machines Become Intelligent?

Artificial Intelligence makes the machines intelligent. Programming along with some aspects of human intelligence like decision-making and problem-solving, gives rise to intelligent machines. Machines are fed with enough data and correct algorithms to make them intelligent.

Data + Algorithm = AI Machine

Ai Task

#Collaboration & Teamwork

Make two teams. There will be a bowl of chits with words, circle, square, white, tall, green, and wet. Based on the chit selected, both teams will have to name a thing. If, a team would not be able to name a thing correctly, will lose the game. For example:

Team 1: Word-Round

Team 2: Cake

Team 1: Ball

Team 2: Apple

Team 1: Bangle

Team 2: Pencil

Team 2 loses.

The purpose of this activity is that the students will become aware of how machines identify a real-life object based on some criteria. In the example criterion is a round object.

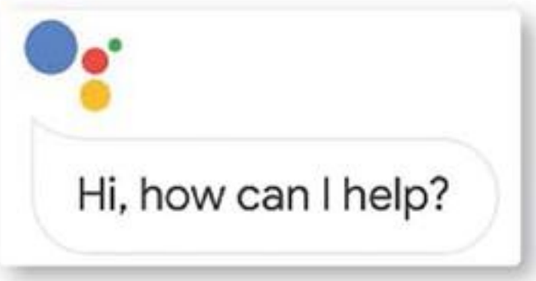
AI Around Us

When you pick up your smartphone to click a picture, it turns to portrait mode, here you use AI whether you know it or not. From the notifications that you received on your social networking account to the advertisements of the upcoming new web series, everything is AI-curated.

The following are some of the examples of AI around us:

- **Smartphones:** The built-in smart assistants (like Siri) are some obvious examples of AI. Google's AI-powered predictions have a visible impact on every person's life. The portrait mode of the camera in our smartphone is also an AI feature. It makes the background blur while focusing on the foreground object.

- **Email Spam Filters:** Email categorisation and spam filters are some powering features of AI that affect our inbox. Simple rule-based filters are used to mark spam or put email into various categories as Primary, Social, Promotion or Important.



- **Virtual Assistants:** Smart virtual assistants that we use to control our smart house are prime examples of AI impacting our daily lives. They use AI to study our behaviour and patterns so that they can adjust themselves automatically. They are capable to do several things like send quick messages, set reminders, check the weather and get the latest news.

- **Social Media:** When you are posting a picture on your social media account, the social media account automatically identifies the people and gives suggestions to tag them. From the feeds to see on the timeline to the notifications that you receive from these apps are all AI-based.

- **Music and Media Streaming Services:** Music apps like Spotify or media streaming apps like Netflix, Hotstar, or YouTube are primarily AI-based apps which make decisions for us. The type of content that you watch becomes the base of the next recommendations for you.

- **Video Games:** AI is used to control the creation of characters, animals or machines in games. The machine makes moves and actions based on the input given by the player.

- **Navigation:** AI takes charge of your navigation through Google Maps, Uber, or even when booking flights/hotels. The apps used to make reservations use AI to give you suggestions for alternate routes to be taken to avoid traffic. When you book your cab, it uses AI to give suggestions for both pricing and the type of car.

- **Security and Surveillance:** AI-enabled security cameras cover the footstep and do the analysis of the moves taken by the intruders. They are smart enough to do real-time monitoring.

- **Social Media Filters:** AI-based Snapchat filters capture the pixels of the image scanned through a webcam and can build a face with different effects as desired by a person.

Brainy Fact

In December **1955**, Herbert Simon and Allen Newell developed the Logic Theorist, the first artificial intelligence program.

What is Not AI?

Every automated gadget around us is not necessarily AI-based. The following are some examples of gadgets that are not AI-based:

- **Fully Automatic Dishwasher:** It can work on its own but requires input from humans. You can select different parameters and commands, and based on your choices, the necessary action is taken. Hence, it is an example of automation and not AI.
- **IP-Enabled Security Cameras:** They can be accessed remotely with the help of the internet but still need a human touch. So, it is an example of the Internet of Things (IoT).
- **Robots:** They are generally considered intelligent, but some robots that can only perform one task based on a specific instruction. These robots are extremely efficient, but they are not intelligent. For example, industrial robots are built for one type of task only, and they cannot perform anything else.

AI Reboot

Identify what is AI or what is not AI from the following statements. Write YES if it is AI or write NO if it is not AI.

a. An online shopping website displays personalised recommendations to its users based on their previous searches and purchases. _____

b. A robot which is programmed to carry out a repetitive series of movements. It does not have any intelligence. _____

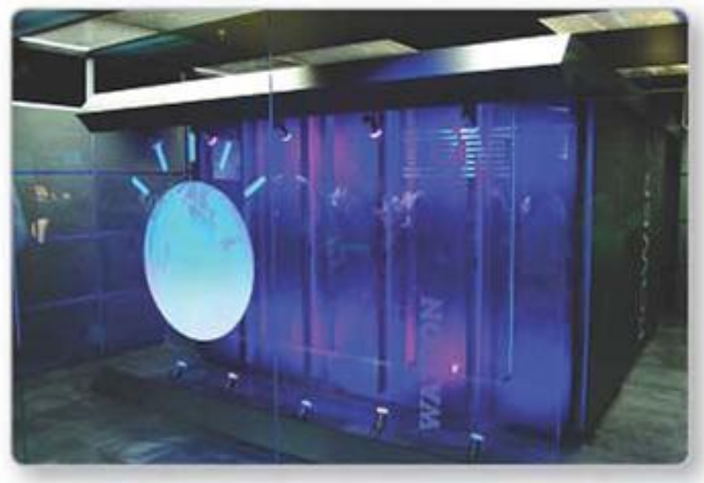
c. A device with fingerprint scanner to record the attendance of students and teachers. It displays records when somebody requests for any record. _____

d. A software program that replies to your queries instantly. It is also known as chatbot. _____

e. A smart device that understands your voice and works according to given commands. It is also known as virtual assistant. _____

World Famous AI Machines

Some of the world-famous AI-enabled machines are as follows:



- **IBM Watson:** It is a question-answering machine that combines artificial intelligence (AI) and sophisticated analytical software. It answers the questions posed in natural languages. Companies use it for analysing the data, predicting future growth prospects, and automating some tedious and complex processes. (https://www.youtube.com/watch?v=s_wgf75GwCM)

- **Google's Driverless Car:** Google launched its Waymo division to design, manufacture, and market driverless vehicles around the world. These cars are AI-enabled cars.
  (https://www.youtube.com/watch?v=cdgQpa1pUUE)

- **Sophia, the Humanoid Robot:** It was designed by Hong Kong-based company, Hanson Robotics, in February 2016 and has made her first public appearance in March 2016 in the USA.
  (https://www.youtube.com/watch?v=WATLfjRHySU)

- **The Assistant/Chatbot—Alexa, Siri and Google's Home:** They are intelligent personal assistants that do jobs based on commands given to them.
  (https://www.youtube.com/watch?v=HDUl-TpObVc)

- **Honda Asimo:** It is a humanoid robot created by Honda in 2020.
  (https://www.youtube.com/watch?v=1urL_X_vp7w)

- **Boston Dynamics AI Robot:** They are four-legged robots designed by Boston Dynamics for commercial applications.
  (https://www.youtube.com/watch?v=NR32ULxbjYc)

Ai Task

#Creativity & Innovativeness

Let's get imaginative and draw a sketch of an intelligent motorbike on a chart paper. It is the year 2030, add features to create a machine that races against time.

Importance of AI

AI has impacted all the fields and sectors. It has changed the conventional functioning of machines. AI means equipping machines with the power to think and make decisions just like human beings. Machines become intelligent with Machine Learning. We provide information to the machines to make them learn from their patterns and behave intelligently.

Let us understand some of the importance of AI:

- **Reduce Time and Increased Accuracy:** With the invent of AI, real-life problems that involve long and complex calculations can be done faster with more accuracy. For example, price comparison websites use long algorithms to choose the right plan for you after performing the comparison of prices.
- **Making of Robots:** AI enables the creation of robots capable of performing tasks beyond human capabilities. In pandemic time, when humans are vulnerable to virus attacks, robots can be easily used for vaccination and patient care. With the help of AI, such robots can be made.
- **Automation:** With virtual assistants like Siri, Alexa, etc. and chatbots, AI have significantly simplified daily tasks. The feedback of a food delivery app is an example of a chatbot using AI.
- **Assist for Differently Abled Individuals:** AI-based software and hardware are available in the market that assist differently abled individuals to do their tasks. Awaz, BillionAbles and Let Me Hear Again are some examples, which uses AI to augment the abilities of individuals with disabilities.

AI in India

AI as a technology has evolved in every field. It is the fastest-growing sector with India having the biggest stake in AI development. This technology has its roots in our country's leading technology institutes. These institutes have initiated and encouraged AI researchers and startups.

The Deccan Article notes that the first Community Centre for Artificial Intelligence was launched in Hyderabad. They also mentioned that The HexArt Institute is an initiative of the Hexagon Capability Center India (HCCI). The center will train over 350 students in several batches per year.

The favourable ecosystem, economy and the vast pool of talent in India have brought many big companies of the world like Google, Microsoft, IBM, etc. to set up their research centers and AI labs in India.

Recognising the AI potential to transform economy and development, NITI Aayog was set up to establish the National programme on AI. NITI Aayog has partnered with leading AI technology stakeholders to implement AI in critical sectors—Medical and Agriculture. The strategy is known as #AIforAll, which implements the growth of AI at school level and go up till research.

INDIAai is the National AI Portal of India. It is a central hub for everything related to AI in India. It is a joint initiative of Ministry of Electronics and IT (MeitY), National e-Governance Division (NeGD), and NASSCOM.

Brainy Fact

In 2019, CBSE introduced AI as a skilled subject for grades **8 and 9**. It's the first board in the world to introduce it as a discipline at a school level.

Human-Machine Interaction

Human-Machine Interaction (HMI) can be defined as the communication or interaction between humans and machines through a user interface to fulfil a specific task or operation. With the help of the user interface, a human communicates with a computer while working on the computer. In human-machine interaction, hardware and software plays a major role.

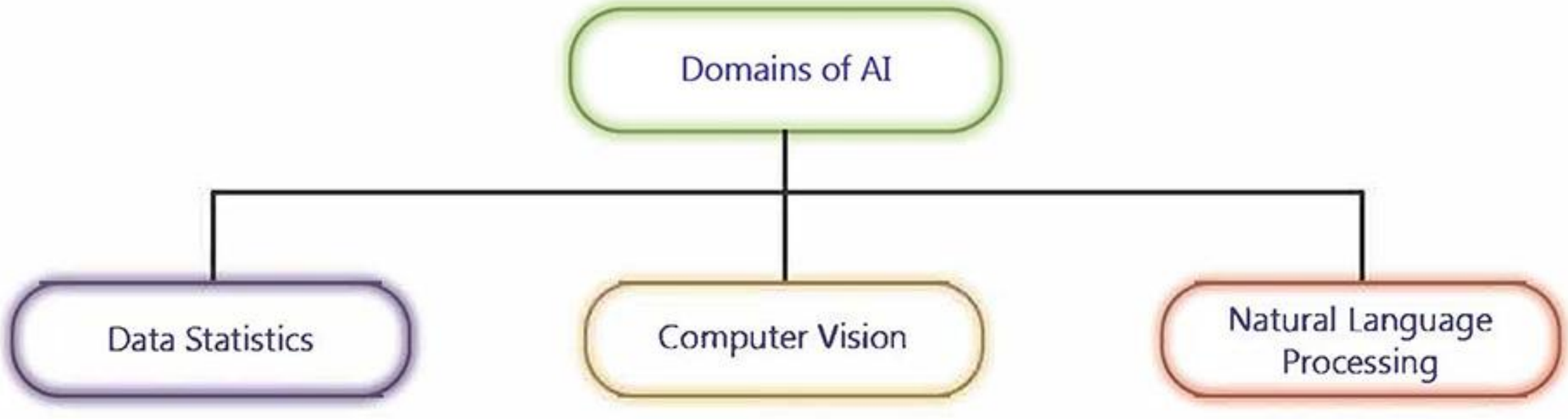
Nowadays, natural user interfaces (NUIs) have gained attention of the humans. NUI is a type of sensory input system that is invisible to the user. They allow humans to interact with the machine in natural ways like touch, speech, and gesture. The main aim of an NUI is to create seamless interaction between the human and machine. In this type of HMI, sensors are used to capture human postures and motions. For example, the Microsoft Kinect sensor captures your body movement and controls the character in the game.

Now, let us learn about the domains of AI.

Domains of AI

As we have discussed in the previous segment, human intelligence is composed of various domains like perception, reasoning and learning. Similarly, Artificial Intelligence is also composed of three domains which are Data Statistics, Computer Vision and Natural Language Processing. They are quite distinct from each other; they together constitute the concept of artificial intelligence.

When we interact with an AI machine, we actually interact with these domains of AI. HMIs are done through these three domains of AI:



Data Statistics

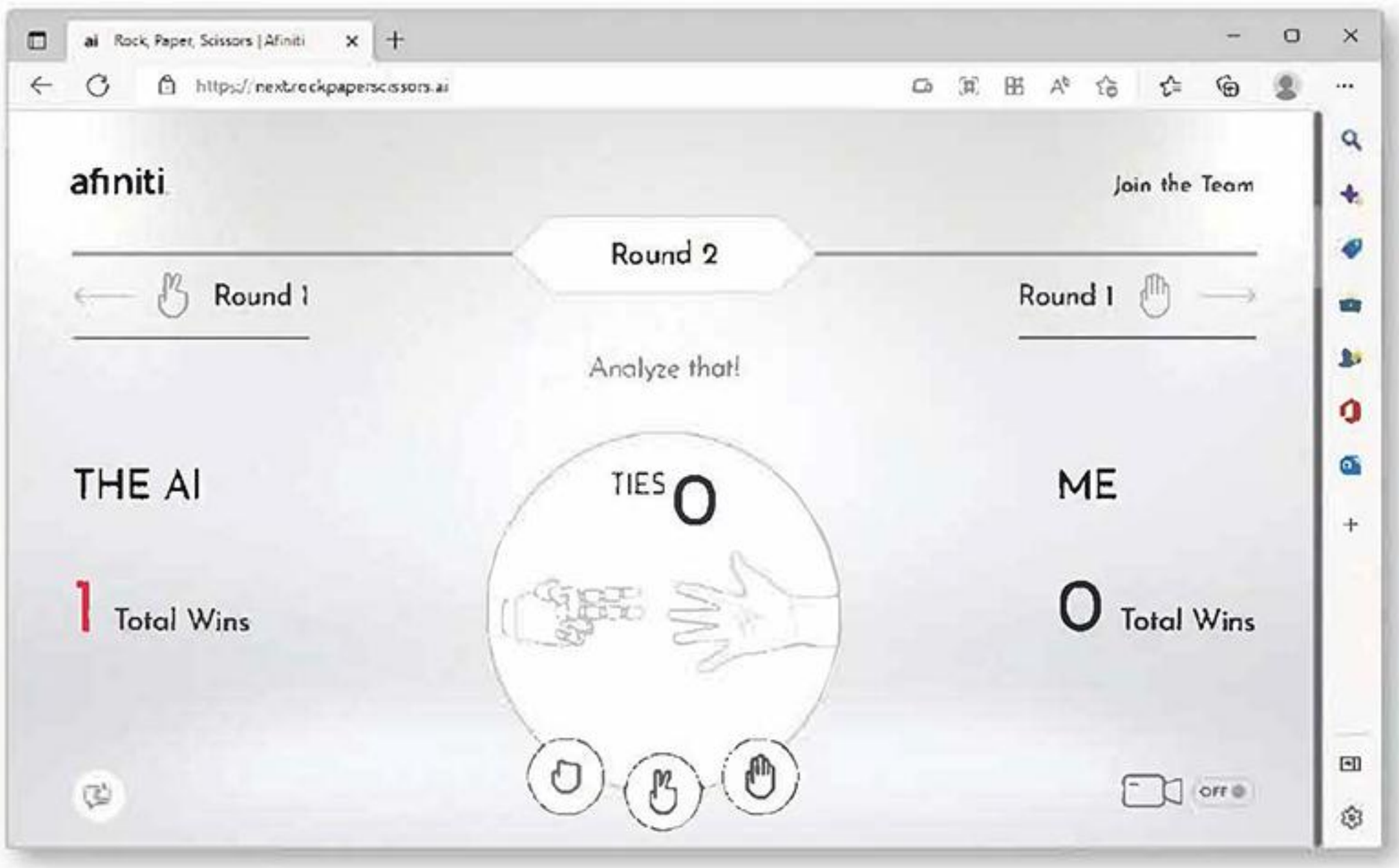
Data and data statistics are crucial elements in the realm of data analysis, providing the foundation for extracting meaningful insights and making informed decisions. Under this domain, the type of input data can be numeric (0–9), text (A–Z or a–z), or special symbols (#, @, $, etc.). The collection, analysis, interpretation, presentation, and organisation of data are called data statistics.

More the data, the better will be the analysis and the more accurate would be the prediction. Thus, AI requires large amounts of data to find the latest trends and patterns. For example, I plan to organise a social gathering in an open-air setup in the month of August in Delhi. I will have to look for a weather forecast for the same and also look at the previous years' trends. So, data collection is the base for analyses and pattern recognition models. From those patterns, predictive models can be made.

So, the data is the most important part of an AI machine. After the data is collected from different sources, the AI machine analyses the data and then processes it.

#Experiential Learning

Ai GAME 01 **Rock Paper and Scissors**



Visit: https://next.rockpaperscissors.ai/ or scan the QR code to play the game.

The challenge here is to win 20 games against AI before AI wins them against you. Answer the following questions after playing the game:

1. Did you manage to win?

2. What was the strategy that you applied to win this game against the AI machine?

3. Was it different to play Rock, Paper & Scissors with an AI machine as compared with a human?

4. What approach was the machine following while playing against you?

It is a game based on data statistics domain of AI where the machines try to predict the next move of the participant. It is made on similar rules as a basic rock, paper and scissors game we played in our childhood days. Learning from the previous moves of the player the machine tries to win ahead with the participant. With every game, the machine is learning from your moves, and able to play it better.

Computer Vision

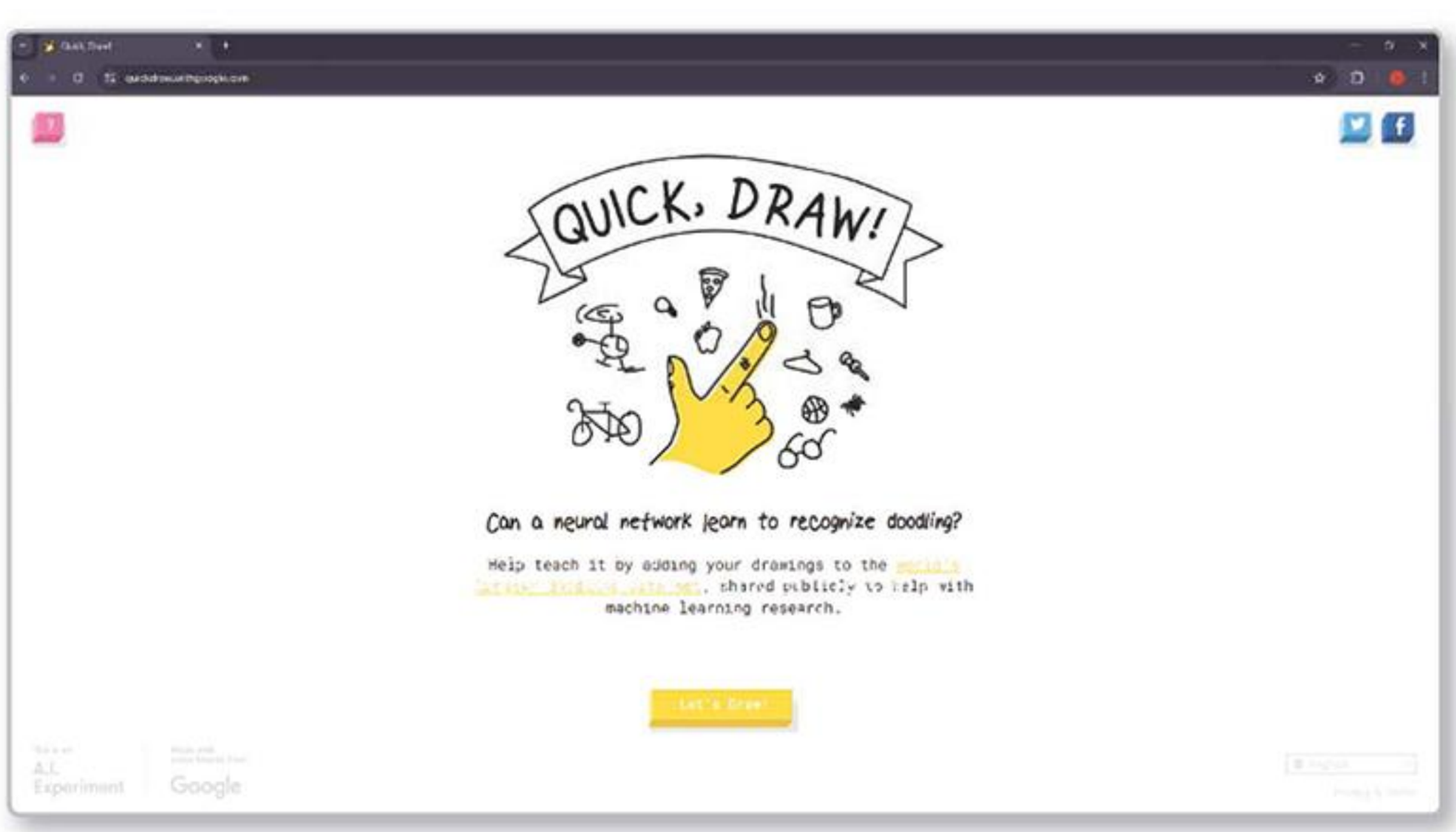
We use our vision to sense and identify objects around us. In the same way, AI machines use the computer vision domain to understand their surroundings. Computer Vision (CV) is the domain of artificial intelligence that is used to train computers to read, process, and analyse visual data in the same way as humans do. The type of data in CV is images and videos. The AI machine collects data from digital images and videos, and then process the data to identify the objects in the image/video. For example, a self-driven car scans live objects, like traffic signals, analyses the scanned image, and then creates the 3D version of it. After that, the car decides whether to run or stop. Some other applications of CV in AI are facial lock in smartphones, unusual behaviour detection, object classification, home security systems, office security systems, and drone-based surveillance systems.

#Experiential Learning

AI GAME 02

Quick Draw

Quick Draw is a game developed by Google that uses machine learning to guess what you're drawing. It prompts you to draw an object or concept within 20 seconds, and as you draw, a neural network attempts to recognise your doodle in real-time.



Visit: https://quickdraw.withgoogle.com/ or scan the QR code to play the game. The challenge here is to draw 6 doodles within the time limit of 20 seconds each.

Answer the following questions after playing the game:

1. Did you manage to win?

2. What was the strategy that you applied to win this game?

3. Was the neural network able to identify all the doodles created by you?

Brainy Fact

ChatGPT is a large language model chatbot developed by OpenAI. It is a powerful tool that can be used for a variety of purposes, including generating text, translating languages, and writing different kinds of creative content.

Natural Language Processing

Have you ever thought about how applications like Google Assistant, Alexa, and Siri understand our commands and work accordingly? Which domain of AI is used in such type of applications? These applications do all the jobs with the help of Natural Language Processing (NLP) domain of AI. NLP gives the ability to machines to read, understand, and analyse meaning from human language. The types of data used in NLP are text and speech. Applications of AI in NLP are chatbots, virtual assistants, autocorrect, sentiment analysis, and auto-sentence completion.

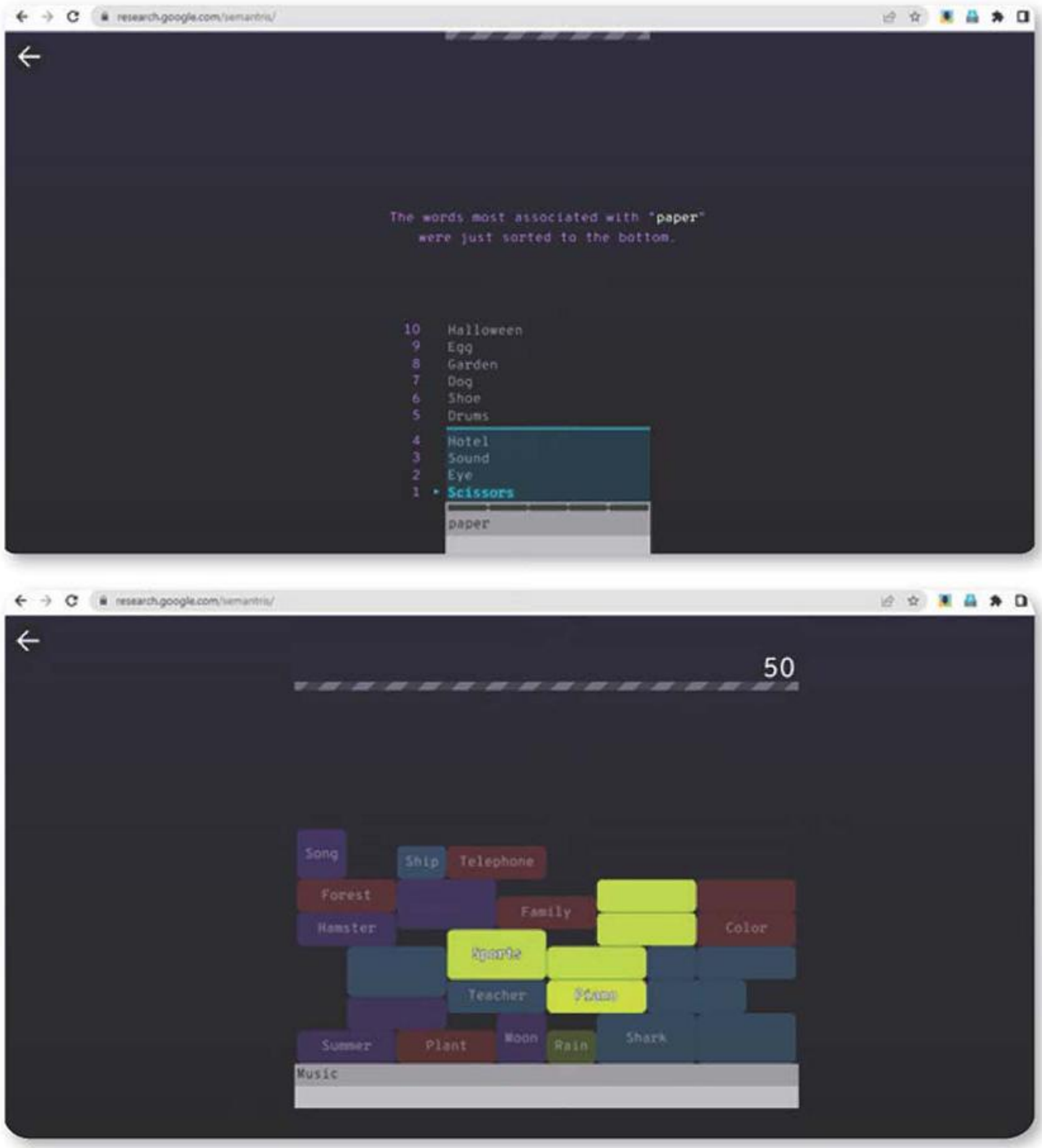
#Experiential Learning

AI GAME 03

Semantris (based on Natural Language Processing – NLP)

Visit: https://research.google.com/semantris/ or scan the QR code to play the game.

Semantris is a word association game based on NLP. This game can be played under two categories, Arcade and Blocks. It gives you a set of words and based on your clue, AI looks for the related words for which it is trained.



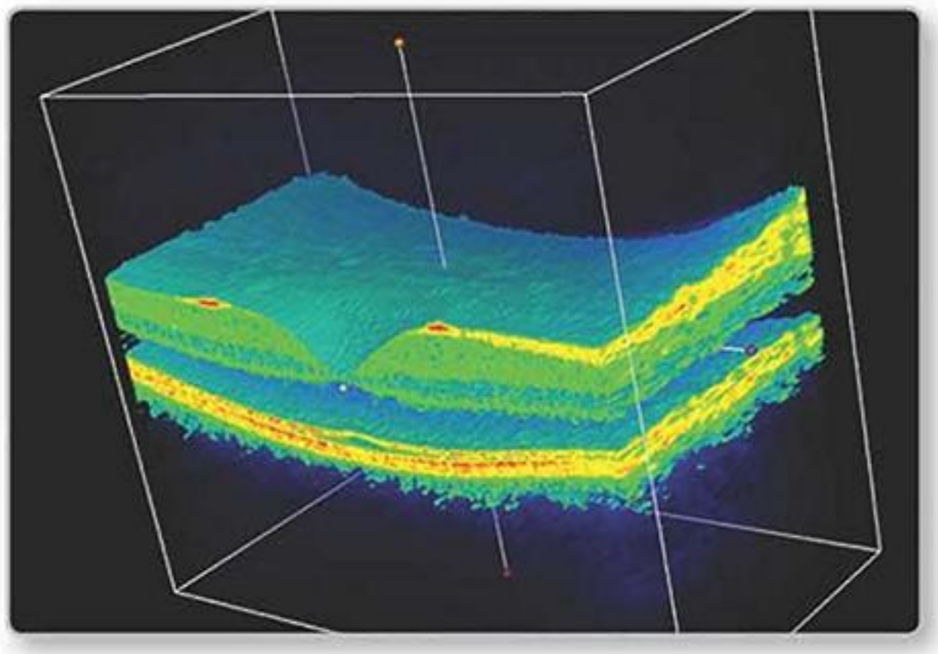
Ai Reboot

Identify which AI domain is used in the following applications and write in the right-hand side column. Take help from the Internet, your teacher and your parents.

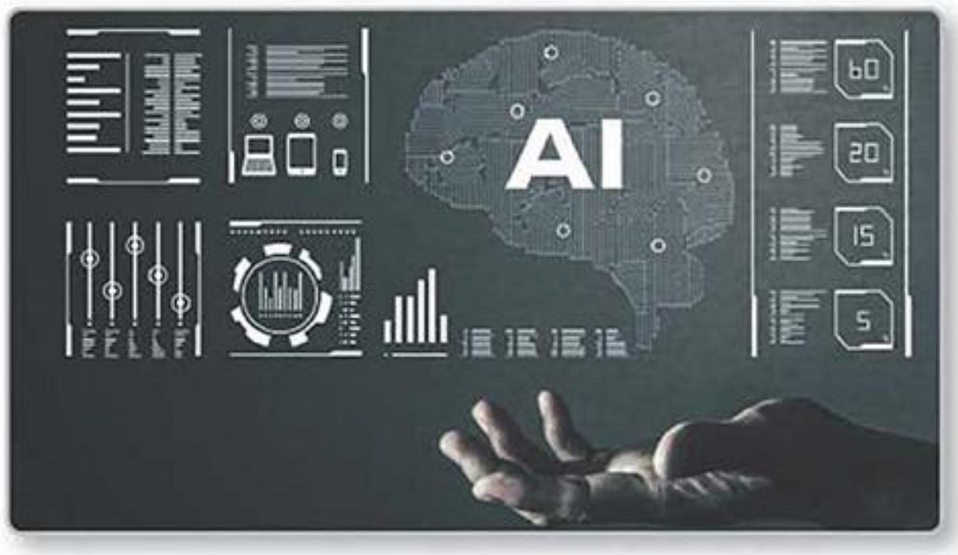
Application	Domain
Google Image Search	
Akinator	
Face-Recognition System in Mobile	
Cortana	

Applications of AI in Real-Life

Let us learn about some of the applications of AI in real life.



- **AI in Healthcare:** For saving human lives, the medical industry is relying on AI on many fronts. Healthcare organisations are using IBM Watson for medical diagnosis. Google's DeepMind has successfully developed a system that can analyse retinal scans and spot symptoms of sight-threatening eye diseases. AI is used in diagnostic centres to analyse samples of tissues and provide accurate results.



- **AI in Education for Automated Grading System:** AI in the assessment process provides real-time learning feedback to teachers and students. Through Machine Learning and data analysis using AI, human patterns of data are studied. This helps in a quick and fair grading system without human intervention.

The Telangana State Board of Intermediate Education in India had announced the use of AI for accuracy in their exam results and provide fair results to all students. Pearson, the multinational publishing and educational organisation uses AI-based assessment systems in ELT, to provide unbiased and accurate results.

- **AI in Business:** For a business to flourish and make profits, it's important that it is able to sell its product or services. AI is used in target advertising, sales and business forecasting. It provides data-based decision-making at all levels of the business. Chatbots can be used to answer FAQs.

- **AI in Agriculture:** The world will need to produce 50 percent more food by 2050 as we are exhausting our resources. The only way this can be possible is when we are using it more wisely. AI can help farmers to get more from the land, and use resources more sustainably. Blue River Technology developed a robot called See & Spray which uses Computer Vision and image recognition software to monitor and precisely spray pesticide on cotton plants. Plantix mobile app uses AI-powered image recognition software to help farmers to detect plant diseases.

- **AI in Banking and Finance:** Trading mainly depends on the ability to predict accurately. Machines are used because they can analyse huge amounts of data quickly. Machines use AI to study patterns and trends in the data and predict how these patterns may repeat in the future. Nomura Securities (Japanese brokerage house) is using AI to analyse the insights of experienced stock traders. AI in banking is growing at a fast pace. Many banks have already adopted AI-based intelligent systems to provide customer support to detect anomalies and credit card frauds.

- **AI in Gaming Industry:** One of the biggest accomplishments of AI is in the gaming industry. In video games, AI is used to generate intelligent behaviour for game characters similar to human-like intelligence. AlphaGo, an AI program that plays the board game Go, defeated a professional world rank no 1 player, Fan Hui.

- **AI in Space Exploration:** Astronomers uses AI to shift through years of data obtained by the Kepler telescope to identify a distant eight-planet solar system. AI is also used in NASA's mission to Mars. The AEGIS, a Mars-based AI robot, already on the planet is responsible for handling the autonomous targeting of cameras perform investigations on Mars.

Brainy Fact

Chandrayaan-3 was a lunar exploration mission by the Indian Space Research Organisation (ISRO). It was launched on July 14, 2023 and successfully soft-landed on the Moon's south pole on August 23, 2023. It is India's third lunar exploration mission and the first to land on the Moon's south pole. The mission aims to explore the region for water, ice, and other resources.

- **Autonomous Vehicles for Advanced Features:** The development of autonomous vehicles will revolutionise the transportation system. Waymo, after many test drives, launched their first public riding services. Waymo's AI software crunches data from vehicle's lidar, camera, GPS, and cloud services to produce control signals that operate the driverless vehicle.

Advanced deep learning algorithms can accurately predict what objects in the vehicle's vicinity are likely to be, making it safe. Tesla, a company known for self-driving cars, uses AI to implement computer vision, image detection, and deep learning to make cars that automatically detect objects and drive without human intervention. Elon Musk, CEO of Tesla Motors says "Tesla will have fully self-driving cars ready by the end of the year and a 'robotaxi' version—one that can ferry passengers without anyone behind the wheel—ready for the streets".

- **AI in Assistance:** Virtual assistance has become a very common technology that can be found in most of our houses and can control our homes. Amazon Alexa, Apple's Siri, and Microsoft Cortana are gaining popularity because of the user experience they provide. Amazon Echo is an example of how AI can be used to translate human language into desired actions. This device uses speech recognition and NLP to perform an ever-growing range of tasks on your command. It can play your favourite song, control your smart device, book cabs for you, order your favourite food, check weather conditions, etc.

- **Social Media for Serving Personalised Experience:** Since social media has become our identity, they have been generating innumerable amounts of data through chats, tweets, and posts. On social media platforms like Facebook, AI is used for face verification wherein machine learning and deep learning are used to detect facial features and tag your friends. Deep learning is used to extract every minute detail from an image by using a bunch of deep neural networks. Machine learning algorithms are used to design your feed based on your interests. X (formerly known as Twitter) is using AI to identify hate speech and terrorist language in tweets. It uses machine learning, deep learning, and NLP to filter out offensive content. Deep learning is a subset of machine learning composed of algorithms that permit software to train itself to perform tasks, like speech and image recognition by exposing multi-layered neural networks to vast amount of data.

- **AI in Artificial Creativity:** Imagine, an AI machine tries to create music and art. MuseNet, a deep neural network, can generate 4-minute compositions with 10 different instruments and can combine styles. Another creative product of AI is Wordsmith, a content automated tool. Wordsmith is an AI-powered tool that produces written analytics by transforming the given data. It uses NLP to transform your data into exciting narratives.

Advantages of AI

The following are the advantages of AI:

- **Increased Automation:** AI can be used to automate anything, ranging from tedious tasks to the process of recruitment of employees. There are AI-based applications that can be used for the hiring of new recruits. Mya, is an AI app that automates tedious parts of the recruitment process such as sourcing, screening and scheduling.

- **Increased Productivity:** AI is widely used in businesses. It is used to manage highly computational tasks that require maximum effort and time. Starting from staff recruitment to automated packing of products, AI has the potential to increase productivity.
- **Smart Decision Making:** AI helps in making smart decisions. Salesforce Einstein Analytics is a comprehensive AI for CRM (Customer Relationship Management), designed to enable companies to make smarter business decisions. The goal of this technology is to give sales and marketing departments more comprehensive customer behaviour and sales prospects.
- **Solve Complex Problems:** AI is used to solve complex problems that cannot be solved by human beings. Through the years AI has progressed from simple machine learning algorithms to advanced machine learning concepts that have helped resolve complex problems like fraud detection, medical diagnosis, weather forecasting and so on.
- **Strengthens Economy:** AI is estimated to contribute $15 trillion to the world's economy by 2030. It is estimated that the greatest impact of AI will be in the field of healthcare and robotics. The rise in the economy will mainly be from the substitution of work by automation and increased innovation in products and services.
- **Personalisation:** Personalisation techniques can be simplified using AI. It is now easiest to target customers with the right product. Thread, a UK based fashion company uses AI to provide personalised clothing recommendations to each customer.
- **Global Defense:** The most powerful robots in the world are built with global defence in mind. One example of AI in global defence is The AnBot. The AI-based robot developed by the National Defence University can carry out automatic security patrols and guards against terrorists and rioters.
- **Disaster Management:** Precise weather forecasting assisted in planning outdoor events easier. But even the smallest advancements in predicting the weather, majorly impacts the market. Accurate forecasting allows the farmers to make critical decisions about planting and harvesting.
- **Enhances Lifestyle:** AI is branching out into every aspect of our lives and helping us live a better life. We use AI systems to interact with our phones and speakers through voice assistants like Siri, Alexa, and Google. Cars made by Tesla using AI for self-driving cars. Even Google gives us recommendations based on our activities.

Ai Task

#Problem Solving & Logical Reasoning

Name any three job opportunities where "Humans Need Not Apply".

_____

_____

_____

Disadvantages of AI

Elon Musk says "*AI is a fundamental risk to the existence of human civilisation.*"

The important thing to remember is the consequences of your actions while applying AI. Some of the disadvantages of AI are:

- **Expensive Technology:** As AI is advancing day by day, the hardware and software need to get updated with time to meet the latest requirements. Setting up AI-based systems requires high costs because of the complexity of the engineering that goes behind its making.

- **Leads to Unemployment:** With the rapid development of AI, the fear of unemployment is constant. Jobs in manufacturing, agriculture, food service, retail, transportation, logistics, and hospitality are some of the industries likely to be affected. The majority of the repetitive tasks would be taken over by AI.
- **Lacks Emotions and Creativity:** AI machine lacks human emotions and creativity. AIs can become skilled machines but they can never acquire the abilities of humans. The creativity of AI is only limited to the ability of humans that created them.
- **Does Not Improve with Experience:** Humans learn from experiences, whereas it's not possible with machines. AIs cannot alter their responses based on the changing environment. They are programmed to behave in a specific manner, so they cannot make decisions in case they encounter an unprogrammed situation. If a change is required, they need to be re-programmed.
- **Discouraging Human Creativity:** Apps like ChatGpt and others can be used with ease to do anything and everything.

Ice Breaker Activity

#Communication

Balloon Debate

Say: "We are going to debate about the boon and bane of various AI applications in the different industries you researched. This will be a 4 v 4 debate. As you know, each theme has been given to two different teams. Now one team out of these two will be in favour of AI applications of that theme, while the other one will be against AI applications in the same theme. The debate will go theme by theme wherein each member of the team will get a minute to speak. The first speaker of the affirmative team will start the debate after which the first speaker of the rebuttal team will put their points. In this manner, each speaker will get a minute to speak and finally one team will be chosen to be eliminated from the balloon debate depending upon how convincing their points were. The speaker who speaks for more than a minute will get his team disqualified. You will get 15 minutes to prepare your points. And your time starts now!"

Imagine there are two families of four people out for a ride in a hot air balloon. Suddenly, the balloon starts to move towards the earth instead of staying airborne. To stabilise it, one family needs to take the parachute and go out of the balloon or else it will come crashing down.

Who should be thrown out of the hot air balloon?

Ai Task

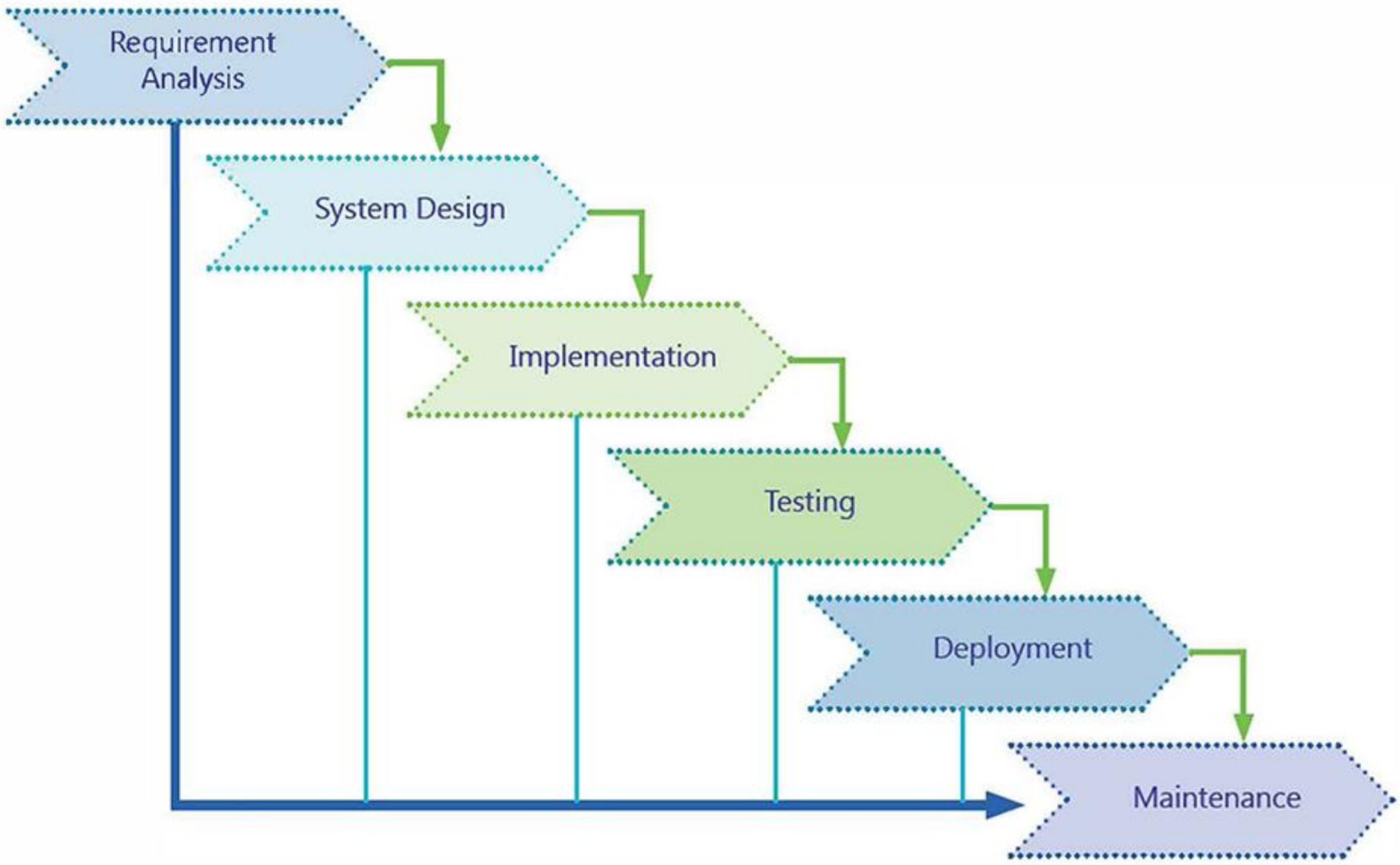
#Creativity & Innovativeness

List down the point why AI is beneficial/ harmful for the society.

AI Project Cycle Framework

Before learning about the AI project cycle framework, let us first learn about the traditional software development cycle. Traditional software development follows the Software Development Life Cycle (SDLC).

SDLC has the following stages:

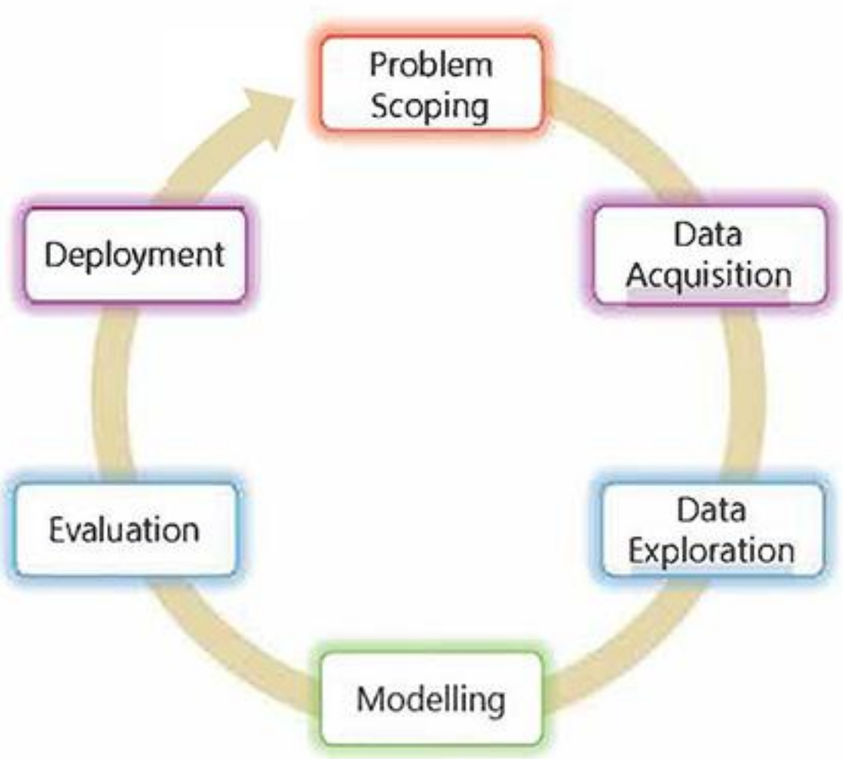


As you can see in the above diagram, the first stage is Requirement Analysis. It is the stage where we have to analyse the required data and information. The next stage is System Design in which we design data flow diagrams like flowcharts from the analysed data to demonstrate the flow of data in the software to be developed. The next stage is Implementation in which the real programs are written. After developing the programs, we need to test the written programs to solve the problem for which the programs are written. If the program is tested successfully then the software is deployed in the client location.

Similar to SDLC, the AI project cycle is the process of converting the real-life problem into an AI-based model. The project cycle framework is designed to help project managers guide their projects successfully from start to end. The purpose of the project life cycle is to create an easy-to-follow framework to guide projects. The AI project cycle provides us with an appropriate framework which can lead us towards our goal.

Stages in an AI Project Cycle

The AI project cycle involves several key stages, each building upon the previous one to develop, deploy, and maintain an AI system effectively. These stages are as follows:



- **Problem Scoping:** The first stage of an AI project cycle is problem scoping to identify the problem and have a vision to solve it. Problem scoping refers to understanding a problem and various factors which affect the problem, and finding a solution for it using AI technology. The 4W's of problem scoping are Who, What, Where, and Why. These Ws help in identifying and understanding the problem in a better and efficient manner.
- **Data Acquisition:** The next stage of the AI project cycle is data acquisition. The term data acquisition means collecting raw data for the purpose of reference or analysis for the project. The data can be in the form of text, numbers, images, videos, or audio and it can be collected from various sources like Internet, journals, newspapers, and so on. The data acquisition system allows us to obtain valuable information about reality to improve the performance of the project.
- **Data Exploration:** Data exploration refers to the techniques and tools used to visualise data collected in data acquisition through complex statistical methods. It is the process of analysing a large dataset.
- **Modelling:** It is the design phase of the AI project cycle. In this, we select the best way to reach the solution. It requires the process of selecting the right algorithm to develop a working model for the project. In this step, different models based on the visualised data can be created and even checked for the advantages and disadvantages of the model.
- **Evaluation:** It is the testing phase of the AI project cycle, where we check if the model can achieve required goals or not. If the model is not fulfilling the requirements, the model or even the data can be changed. Once the developer feels the project is ready, the project will be put into working conditions and then deployed and handed over to the user. If the deployment stage is not reached, the project is of no use.
- **Deployment:** In this stage, we integrate the best-performing model into the production environment, setting up continuous monitoring, and maintenance to sustain performance over time.

Ai Reboot

1. List down the steps of AI project cycle.

2. Differentiate between evaluation and deployment in an AI project cycle.

Why We Need an AI Project Cycle?

The AI project cycle is a structured framework comprising stages from problem definition and data acquisition to model development and deployment. It involves identifying objectives, gathering data, exploring and modelling data, evaluating outcomes, and deploying AI solutions. This iterative process ensures systematic development, validation, and improvement of AI applications aligned with business goals and user needs. We use an AI project cycle for these important reasons:

- **Structure and Organisation:** Provides a clear roadmap and systematic approach for planning, executing, and managing AI projects, ensuring all steps are followed in a logical sequence.

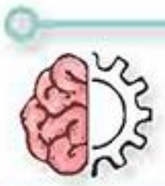
- **Efficiency:** Optimises resource allocation, time management, and task prioritisation throughout the project lifecycle, leading to more effective and timely project outcomes.

- **Risk Management:** Facilitates early identification and mitigation of risks related to data quality, model performance, deployment challenges, and ethical considerations, minimising potential disruptions.

- **Quality Assurance:** Ensures rigorous testing, evaluation, and validation of AI models to meet desired performance standards and business requirements, enhancing reliability and usability.

- **Continuous Improvement:** Supports iterative development and enhancement of AI solutions based on feedback, new data insights, and evolving business needs, fostering innovations, and adaptation over time.

- **Modularity:** Encourages the design of AI solutions in a modular fashion, allowing components to be developed, tested, and integrated independently, promoting flexibility and scalability in project development.



Ai Task

#Creativity & Innovativeness

Case Study: Cleaning Oceans

The world's oceans are increasingly polluted with plastic waste, which poses a severe threat to marine life and ecosystems. Identifying the location and density of plastic waste patches is challenging due to the vast and dynamic nature of the ocean. Traditional methods of detecting and removing plastic waste are inefficient and labour-intensive. Coastal communities and environmental organisations lack the advanced tools needed to monitor and clean up these plastics effectively, leading to continued environmental degradation and harm to marine biodiversity.

Can we solve this problem with AI? How?

Now that you are aware of AI concepts, plan to use them in accomplishing your task. Start with listing down all the factors which you need to consider saving the oceans. This system aims to:

Problem Scoping: Define the problem statement, objectives, and constraints of the AI project. Identify stakeholders, understand the business context, and outline the scope of work to be undertaken.

Define the scope to develop AI models for identifying and removing ocean plastic waste. Identify key challenges such as ocean dynamics, plastic detection limitations, and scalability of cleanup efforts.

Data Acquisition: Gather relevant datasets required for training and evaluating AI models. Ensure data is collected from reliable sources, adheres to legal and ethical standards, and is prepared in a format suitable for analysis.

Gather satellite imagery, drone footage, and oceanographic data from various sources to create a comprehensive dataset. Utilise data from environmental organisations, governments, and research institutions.

Data Exploration: Explore and analyse the acquired data to understand its structure, quality, and relationships. This phase involves data cleaning, visualisation, and statistical analysis to uncover patterns and insights that inform subsequent modelling.

Clean and preprocess the data to extract relevant features such as plastic concentrations, ocean currents, and marine life habitats. Explore visualisation techniques to understand spatial and temporal patterns of plastic waste.

Modelling: Develop and implement AI models using appropriate algorithms and techniques. This phase includes feature selection, model training, parameter tuning, and validation to optimise model performance and accuracy.

Develop AI models such as convolutional neural networks (CNNs) for image recognition to detect and classify plastic debris in ocean images. Implement reinforcement learning algorithms for optimising cleanup strategies based on real-time data.

Evaluation: Assess the performance of trained AI models using evaluation metrics and validation techniques. Validate model predictions against ground truth data to ensure reliability and generalisation ability across different scenarios.

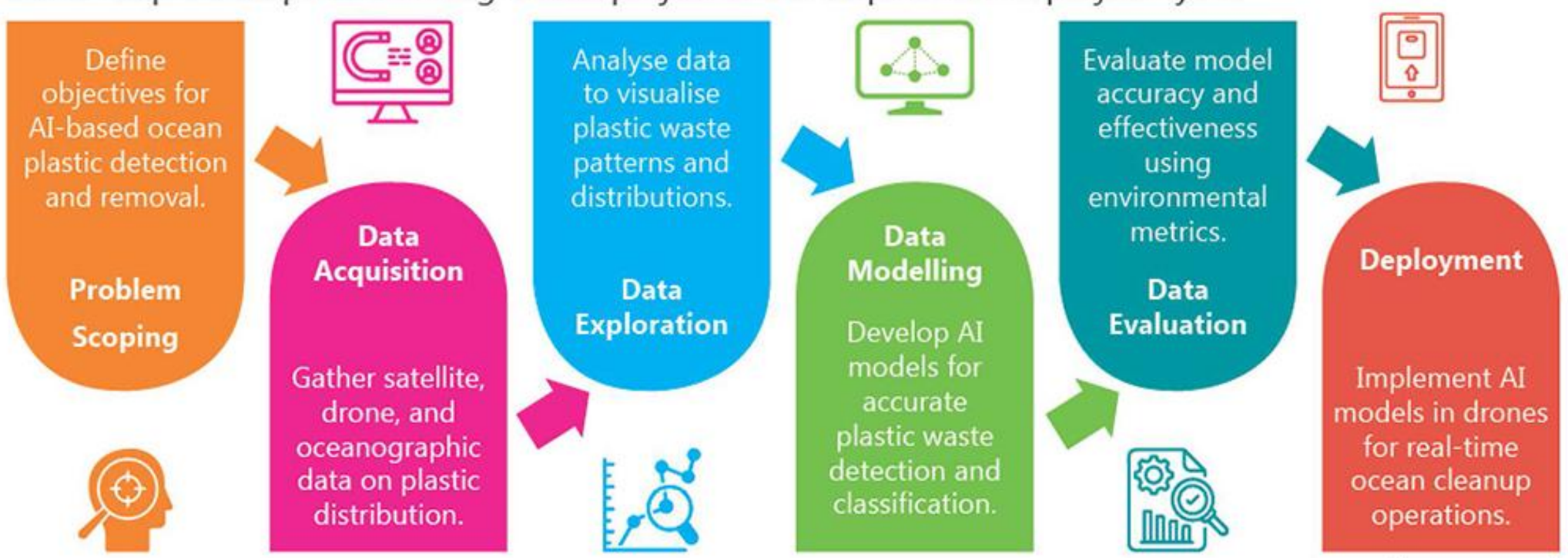
Evaluate model performance using different metrics to ensure accurate detection and classification of plastic waste. Validate models with cross-validation techniques and real-world testing in different ocean regions.

Deployment: Integrate the validated AI models into the operational environment for real-world applications. Deploy models using scalable and efficient frameworks, monitor performance post-deployment, and iterate as necessary to maintain effectiveness and relevance.

Integrate AI models into autonomous drones or underwater robots for real-time monitoring and cleanup operations. Implement cloud-based solutions for scalable deployment across global ocean regions. Continuously monitor model performance and refine algorithms based on feedback from cleanup operations and environmental assessments.

By following this AI project cycle, we can effectively leverage technology to address the critical issue of ocean plastic pollution, leading to improved marine ecosystem.

Let us map the steps of Cleaning Ocean project to the steps in the AI project cycle.

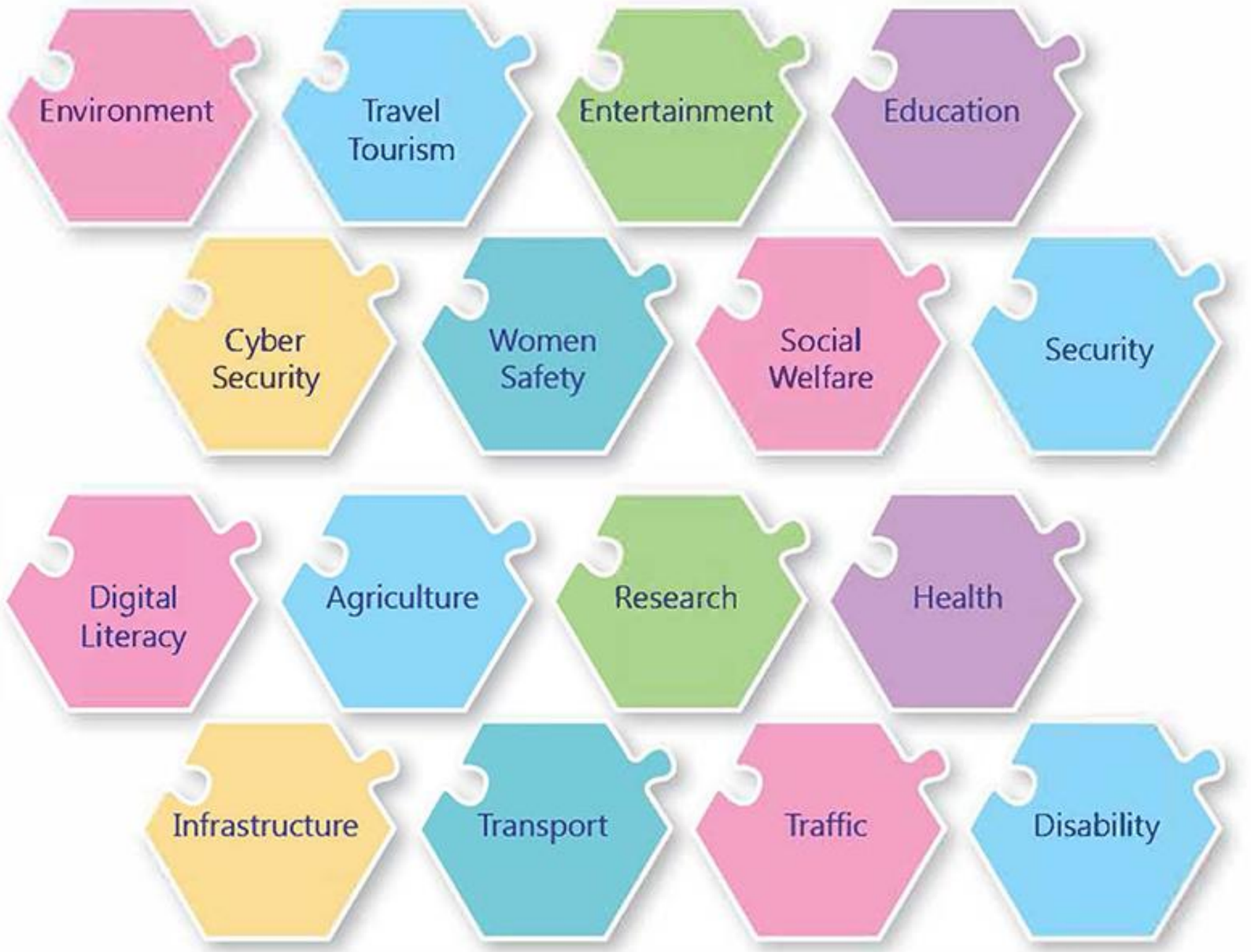


Watch the video-The Ocean Cleanup

https://www.youtube.com/watch?v=xz21cKgRHxI

Problem Scoping and Setting Goals for an AI Project

Problem scoping is the term used to define the process of selecting a problem that we might want to solve using AI knowledge. Identifying a problem and then having a vision to solve it is called problem scoping. Let us start scoping a problem. Look around, we are surrounded by problems, big or small. At times we don't feel the problem, as we are so used to them. Look around and select a theme that interests you the most from the following diagram:



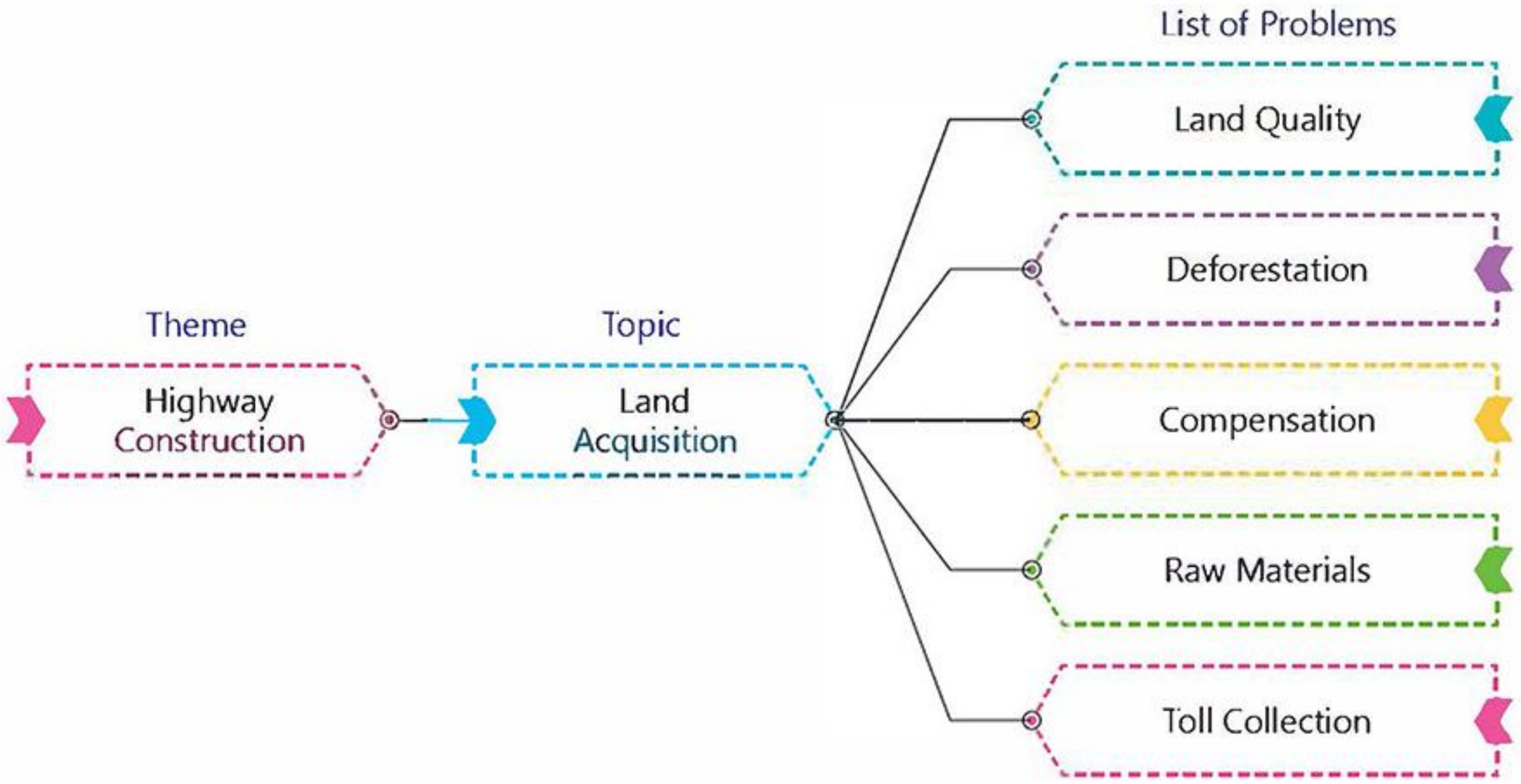
You can select any one from the above diagram. Further you can also select from the 17 Sustainable Development Goals.

In the context of problem scoping, a theme refers to a central topic or recurring issue that emerges from the analysis and exploration of a particular problem space. A theme is a broad term which covers all the aspects of relevance under it. Identifying themes in problem scoping is crucial as it helps to organise and focus the investigation that ensures the problem is understood comprehensively and that solutions are aligned with the core issues.

For Example

In highway construction, there are different issues related to land acquisition, land quality, deforestation, compensation, raw materials, toll collection, etc. Although, these issues are different but are part of the same activity of highway construction. In problem scoping, we take up one issue at a time and elaborate it for better understanding.

Let us fill the theme, topic and problems related to it in the following:



Now, we have identified that there are many problems to solve around us. To establish the goal of your project, choose one problem from the list above that you want to address using your AI knowledge. This problem will become the focus of your AI project, helping you to gain a clear vision of what needs to be achieved.

After determining the goal of your project, let us start working on it.

Some other examples of themes are:

Theme: Vaccination Drive

Vaccine Production, Ordering, Supply, Vaccination Points Identification, Online Registration, Appointment Scheduling, Different Vaccine Distribution and Injection, etc.

Theme: Promotion to Senior School

Subject-wise Vacancy Identification, Class Distribution, Internal Students Promotion, Vacancy Advertisements, Hostel Capacity Management, New Students Registration, Admission, Class Allotment, ID Creation, Fees Collection, Uniform Availability, Books Availability, etc.

Theme: Budget Allocation

Forecasting Tax Collection, Design Schemes to Increase Trade to increase Tax Collection, Develop Infrastructure, Support Banking to support Trade, Manage GDP Growth, Manage Employment, etc.

Identifying the Stakeholders

After setting the goal, we need to identify the people (stakeholders) who would be affected by the AI system when it is developed. Stakeholders are individuals or groups who have an interest in the project or are affected by its outcomes. They can provide valuable vision, support, and feedback throughout the project.

Some of the common people/departments in an organisation that are more affected by an AI system are:

- **HR Department:** The work of the HR department become easy as the AI system will automatically remove the resumes that are not related to the job posting. However, due to the use of AI systems, some people may lose their jobs as AI systems will automate tasks and require less human interaction. Hence, no need to hire more employees.
- **Management:** AI system will reduce the cost of the company as it decreases the total number of employees required.
- **IT Department:** AI system will require a large amount of data to perform the tasks better. So, experienced and expert employees are required to collect data. More employees are also required to develop and maintain the AI system. The AI system will also require more storage space for large amounts of data.
- **End users:** Individuals or groups who will use the AI solution.
- **Data providers:** Entities or systems that supply the data used for training and testing the AI models.

4Ws Problem Canvas

To understand step by step how problem scoping is done we use another method here, known as 4Ws Problem Canvas. This canvas helps us in identifying 4 crucial parameters we need to know for solving a problem.

The 4Ws here are listed as Who?, What?, Where?, and Why?

Who?

Under the "Who" block, we analyse the people who are getting affected directly or indirectly by the problem. These people are the "stakeholders" of this problem. The stakeholders are the people who face this problem and would be benefitted by the solution.

Let's fill the "Who" canvas!

- Who are the stakeholders?

  _____

  _____

- What do you know about them?

  _____

  _____

What?

Under the "What" block, you need to check what is the actual problem. You determine the nature of the problem. Here, you also check what is the problem, and how do you know that it is a problem. To support the evidence of the existence of a problem, newspapers, govt. reports, print media can be considered.

Let us fill the "What" canvas!

- What is the problem?

- How do you know it is a problem? (Is there any evidence?)

Where?

Now, that the problem is identified, and we know with whom it is associated, the next step is to understand the context/situation/location of the problem. This block will help us to know the situation in which the problem arises, the context of the problem, and the location where it is prominent.

Let us fill the "Where" Canvas!

- What is the context/situation in which the stakeholders experience the problem?

- Where is the problem located?

Why?

After listing all the major elements that affect the problem directly, let us now understand who all will be benefited by the solution of the problem. We understood who is affected, the exact nature of the problem, where is it located and where the solution to the problem to be deployed. These three canvases now become the base of "Why" you want to solve this problem. Thus the "Why" canvas thinks about the benefits of the solution to the stakeholders and the society.

Let us fill the "Why" canvas!

- Why will this solution be valuable to the stakeholders?

- How will the solution improve their situation?

Ai Task

#Experiential Learning

4W Canvas: Growing Demand for Water in different seasons. The water supply of drinking water in the city changes with the season. Ensuring a clean drinking water supply is a challenge as demands are changing with time as rivers shrink in summers, but the demand is more for water. Rivers swell in monsoon season, but the demand is comparatively low to that of summer. The water demand further reduces in winter, but there is ample water in the rivers. Autumn sees the demand almost the same as that of summer. The population of the city is also growing as more areas are getting covered under the residential housing societies.

Draw a 4W Canvas to address the problem of Clean Drinking Water Supply for everyone in the city.

Our	City	Who
Has a problem of	Clean Drinking Water Supply for everyone.	What
While	Demands of water supply change with time as rivers shrink in summer, but the demand is more for water. Rivers swell in monsoon season, but the demand is comparatively low to that of summer. The water demand further reduces in winter, but there is ample water in the rivers. Autumn sees the demand almost the same as that of summer. The population of the city is also growing as more areas are getting covered under the residential housing societies.	Where
An ideal solution would be	To ensure a clean water supply for drinking water in the city by changing the water supply according to the different demands in different seasons.	Why

Problem Statement Template

After filling the 4Ws problem canvas, you now need to summarise all the canvas into one template. The problem statement template helps us to put together all the key points into a single template for future reference. Problem statement template with space to fill details according to your goals:

Our	[stakeholder(s)] _____ _____	Who
Has / Have a problem that	[issue, problem, need] _____ _____ _____	What
When / While	[context, situation] _____ _____ _____	Where

An ideal solution would be	[benefit of solution for them] _____ _____ _____	Why

Using Problem Statement Template

People love to indulge in various kinds' food. This is a reason that you find restaurants everywhere. These restaurants serve food in many ways like A la-Carte and Buffets in-order to offer a variety to their customers. All kinds of Food Outlets prepare food in bulk, as they expect a lot of customers would come to enjoy the food every day. For most Food Outlets, at the end of the day, there is a lot of leftover food. This food is a waste, as the Food Outlets don't intend to serve stale food to their customers the next day, to maintain their brand value.

So, every day a specific quantity of food is prepared keeping in mind a probable number of expected customers, which might be more than the actual number of customers who visit. This leads to a good quantity of food getting wasted, which is a loss for the restaurant as they need to dump the food or pass it on free to the NGO's feeding hungry people. Everyday wastage if accounted for the whole year is a big loss for the restaurants.

Now, we have understood the scenario well. Let us take a deeper look into the problem to find out more about various factors around it. Let us fill up the 4Ws problem canvas to find out.

Who?	
Who are the stakeholders?	• Restaurants offering buffets. • Restaurant chefs.
What do we know about them?	• Restaurants cook food in bulk everyday for their buffet to meet their customer needs. • They estimate the number of customers that would walk into their restaurant everyday.
What?	
What is the problem?	• Quite a large amount of food is leftover everyday unconsumed at the restaurant which is either thrown away or given for free to needy people. • Restaurants have to bear everyday loses for the unconsumed food.
How do you know it is a problem?	• Restaurant surveys have shown restaurants face this problem of food shortage.
Where?	
What is the context/ situation in which the stakeholders experience this problem?	• Restaurants that serve buffet food. • At the end of the day, no further food consumption is possible.
Why?	
What would be of key value to the stakeholders?	• If the restaurant has a proper estimate of the quantity of food to be prepared everyday, the food waste can be reduced.

Why?	
How would it improve their situation?	• Less or no food would be left unconsumed. • Losses due to unconsumed food would reduce considerably.

Problem statement template for the above activity is:

Our	Restaurant Owners	Who?
Have a problem of	Losses due to food wastage	What?
While	The food is left unconsumed due to improper estimation	Where?
An ideal solution would	Be to be able to predict the amount of food to be prepared for everyday consumption	Why?

Iterative Nature of Problem Scoping

In the AI project cycle, problem scoping is a very important phase. If it is not handled properly and has flaws then it could lead to failure of the project as well.

The iterative process is an important approach of problem scoping that helps in continually improving a design or product using an AI model. It involves creating a prototype and testing it, and repeating this cycle until you reach a desired AI model. The main advantages of using an iterative approach in problem scoping are:

- Each iteration helps you improve based on the problems identified in the past cycle.
- It is cost effective as the problem is identified and continual testing gives you a clear picture of the status of your project.
- Testing and debugging are easier with smaller and initial iterations.
- You can present the results of each iteration to stakeholders and clients and help you showcase the efficient progression of the project.

Ethical Issue Related to Problem Selection

When identifying an issue for an AI project, consider how it will influence individuals as well as society. These are some important ethical issues:

- **Fairness:** Make sure that the AI system does not unfairly favour a particular group above others.
- **Privacy:** Ensure that the AI system protects the confidentiality of individuals and never collects or uses private data of individuals without their consent.
- **Transparency:** People should know how exactly the AI system functions as well as why specific choices are made.
- **Social impact:** Examine how the AI system may influence society as a whole, and how it might encourage biases or cause of social divisions.
- **Environmental impact:** Examine how AI system could have negative impacts on the environment. For example, consuming a lot of electricity or emitting pollutants.

Data Acquisition

Data acquisition means collecting raw facts, figures, or statistics from relevant sources either for reference or for analysis needed for AI projects. In the process of making an AI project cycle, data acquisition is the second stage. It is a time-consuming process as different types of data are scattered everywhere, and we need to focus on data relevant to our needs.

While acquiring data, you need to collect data in a regular bases or timely manner to ensure it is up-to-date and reflects current conditions or trends. You need to also ensure that the data you acquired is complete and sufficient. If you don't have sufficient data, your analysis may be incomplete or unreliable.

What is Data?

Data is a piece of raw information or facts and statistics collected together for reference or analysis. They are raw facts that need to be processed to get meaningful information. Whenever we want the AI project to be able to predict an output, we need to train it with a data set first. Data plays an important part in an AI project as it creates the base on which the AI project is built.

Types of Data

There are two types of data:

- **Training Data:** It is data on which we train our AI project model. It is basically to fit the parameters of the project for the model. In training data, the output is available to the model.
- **Testing Data:** It is used to check the performance of an AI model. In testing data, the data is not seen for which the predictions have to be made.

For example, if we want to prepare an AI model to predict the school average of students in board examinations, we will feed the marks obtained by students in board examinations in the previous years, this will be treated as training data. Once the model is ready, it will predict the school average for the coming year. Now when we are testing it, we feed the different datasets and that is the testing data.

Data Features

In the data acquisition stage, it is very important that the data we provide to an AI project is relevant. How do we know what data to be used in a problem scoping?

- We need to visualise the factors that affect the problem statement, for which we need to extract the data features.
- We need to find out the parameters that will affect the problem statement directly or indirectly.
- Data features refer to the type of data that you want to collect. In the above example, the data features would be each subject average, the number of students taking the exam, the theory and practical marks distribution of each subject, etc.

Reliable Sources of Relevant Data

Data is the base for any AI project to be built. When the data is acquired, it's important to check if it's from a reliable and authentic source for the accuracy of the project.

Also, the acquisition methods should be authentic so that there's no conflict in achieving project goals.

There are various sources to collect relevant data for our project:

- **Surveys:** Data can be collected from online surveys, telephonic surveys or in-person surveys to collect responses. Surveys are a way of collecting data from a group of people to gain information and insights into various topics of interest. The process involves asking people for information through questionnaires which can be online or offline. It can be considered as a data source.
- **Web Scraping:** Data or information can also be extracted from a website. Web scraping or Data scraping is the method of downloading information from the World Wide Web (WWW) and storing it on your computer for later reference. The data collected in this way is online data.

- **Sensors:** Data can also be collected from various sensors like collecting environmental data and stored in some data storage solutions. Sensors are connected through gateways which enable them to collect live data in the offline mode.
- **Cameras:** Data can be seen, written down or recorded on the computer. Cameras are used to collect data in the form of images. CCTV, web cameras, and surveillance cameras are big sources of visual data that can be acquired from various places.
- **Observations:** It is a method of collecting data by watching facts as they occur. Using the observation technique, data can be analysed and used for testing the model.
- **Application Programming Interfaces (APIs):** APIs are a set of functions and procedures that allow one application to connect to another. So, one of the ways of collecting data is through APIs that can be used to collect data from social media services for analysis.

There are times when, using the internet, we acquire unauthentic data from websites for our AI project. Extracting private data can be an offence. So, keeping this in mind we should ensure the data is collected from open-sourced websites hosted by the government. They are one of the most reliable and authentic sources of information. These portals have information collected in a suitable format that can be downloaded. Some of the open-sourced government portals are data.gov.in, india.gov.in, etc.

After listing the data features, let's understand the concept of system maps.

AI Reboot

List down 5 ways of acquiring data for an AI project.

System Maps

A system map is a diagrammatic representation of a set of things working together. It focuses on the components and boundaries of a system. System map helps us to find relationships between different elements of the problem which we have scoped. It helps to find a solution to achieve the goal of our project. Let us understand system maps with the help of an example.

Streets are safe for pedestrians to walk if the number of people driving on the roads are less.

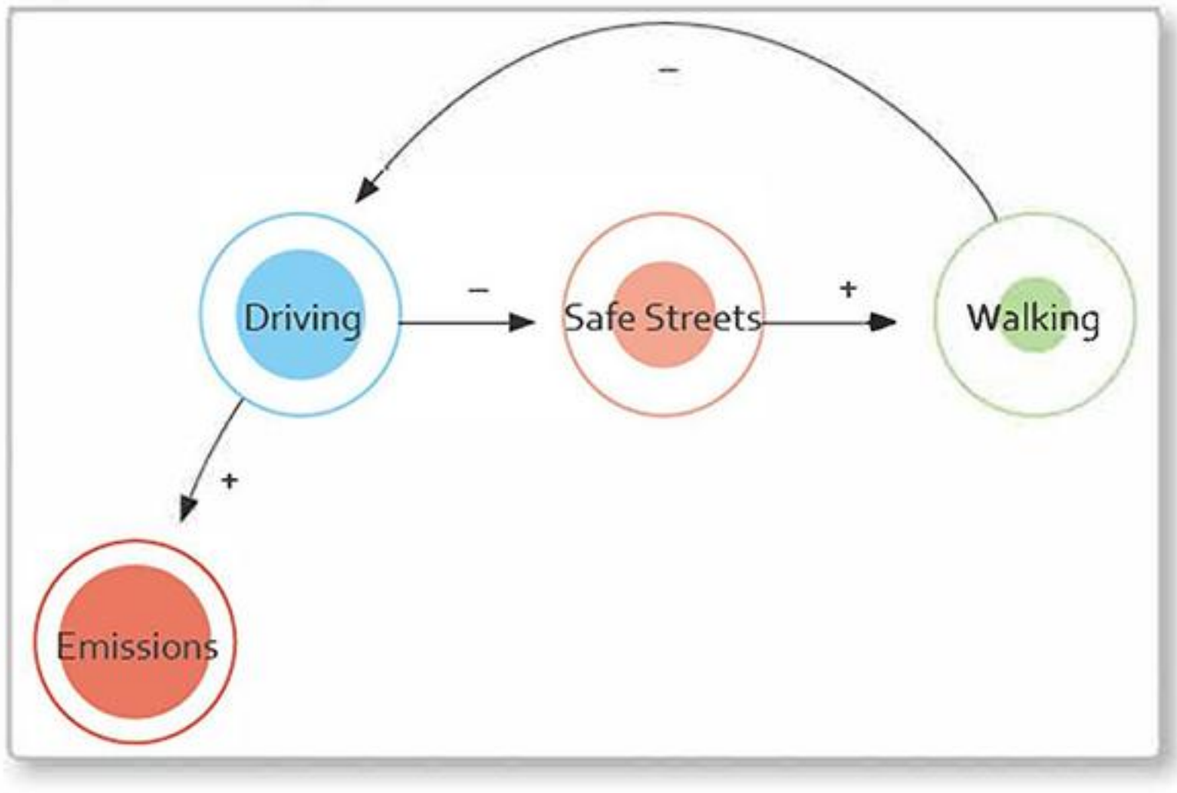
If the number of vehicles on the road increases, the emission levels also increase.

We use system maps to understand the complex issues that have inter-connected factors affecting each other. A system comprises:

- **Elements:** These are different, discrete elements within the system.
- **Interconnections:** These are the relationships that connect the elements.

Rules for system maps are as follows:

- The circles represent elements.



- Arrows are used to represent relationships/interconnections.
- The '+' and '-' signs are indicators of the nature of a relationship. The arrowhead depicts the direction of the effect and the sign (+ or -) shows their relationship.
- If the arrow goes from X to Y with a + sign, it means that both are directly related to each other. That means if X increases, Y also increases and vice versa.
- If the arrow goes from X to Y with a -sign, it means that both elements are inversely related to each other. That means if X increases, Y would decrease and vice versa.

Ai Task

#Experiential Learning

Visit the following link: https://ncase.me/loopy/

and create a System Map for how much quantity of food to be prepared every day in a restaurant. Training data is to be taken as quantity consume for past 20 days and testing data will be the quantity for next 10 days.

Data Exploration

After collecting accurate data, the next step is data exploration. Data exploration means finding the patterns and trends in the data. It is the third stage in the AI project cycle and the initial step in data analysis. It is used to understand what is in a dataset and the characteristics of the data.

Data exploration cleans the big data to provide an input to an AI project. Terabytes of data sitting in the data centre unused is a burden, if correctly processed it can become digital gold.

Ai Task

#Experiential Learning

Activity: Data and Analysis

In reference to Case Study: Cleaning Ocean, observe the 4Ws problem canvas and Problem Statement Template and answer the following questions:

- What are the data features needed?
- How will the features collected affect the problem?
- Where can you get the data?
- How frequent do you have to collect the data?
- What happens if you don't have enough data?
- What kind of analysis needs to be done?
- How will it be validated?
- How does the analysis inform the action?

Also, perform the following tasks:

- Provide the brainstorming solutions for the problem statement.
- Identifying the possible data features affecting the problem.
- Creating system maps considering data features identified.

Data Visualisation

Data visualisation is the graphical representation of data and information. By using graphical tools like charts and graphs, it is an easier way to understand the trends and patterns in data.

Data visualisation can be done through a combination of automated tools and manual methods. It encompasses all aspects of the visual representation. It helps you arrange your scattered data into a structured pattern with specific characteristics following important trends in detail. It also helps to make better decisions.

Why do you think we need to explore and visualise data before jumping into the AI model? The following are some reasons:

- **Understand trends:** Visual representation of data grabs our interest and keeps our concentration. If we see data in the form of numbers, understanding it will take some time. But when we see the same data in the form of a chart, we quickly see trends and outliers.
- **Deciding which model:** Understanding visuals by humans is better than any tabular data format or reports. Data visualisation tools accelerate decision-making based on the data insights, accelerating business growths.
- **Easier to comprehend:** Visualisation is a key tool to make sense of huge data in the form of rows. A good visualisation tool helps to clean big data and highlight useful information. It enables decision-makers to interrelate the data to find better insights and be easy to comprehend.
- **Easier to communicate:** Visualisation lets you communicate large amounts of data to the audience with ease. Interactive data visualisation tools help to communicate data findings and critical information effectively.

Need of Visualising Data

The needs for data visualisation are:

- It simplifies the complex quantitative information.
- It analyses and explores big data easily.
- It identifies the areas for improvement.
- It identifies the relationship between data points and variables.
- It explores new patterns and reveals hidden patterns.

Data Visualisation Tools

There are both manual analysis and automated analysis tools available for data visualisation. These tools help us to visually explore and identify relationships between different datasets. Some of the commonly used data visualisation tools are:

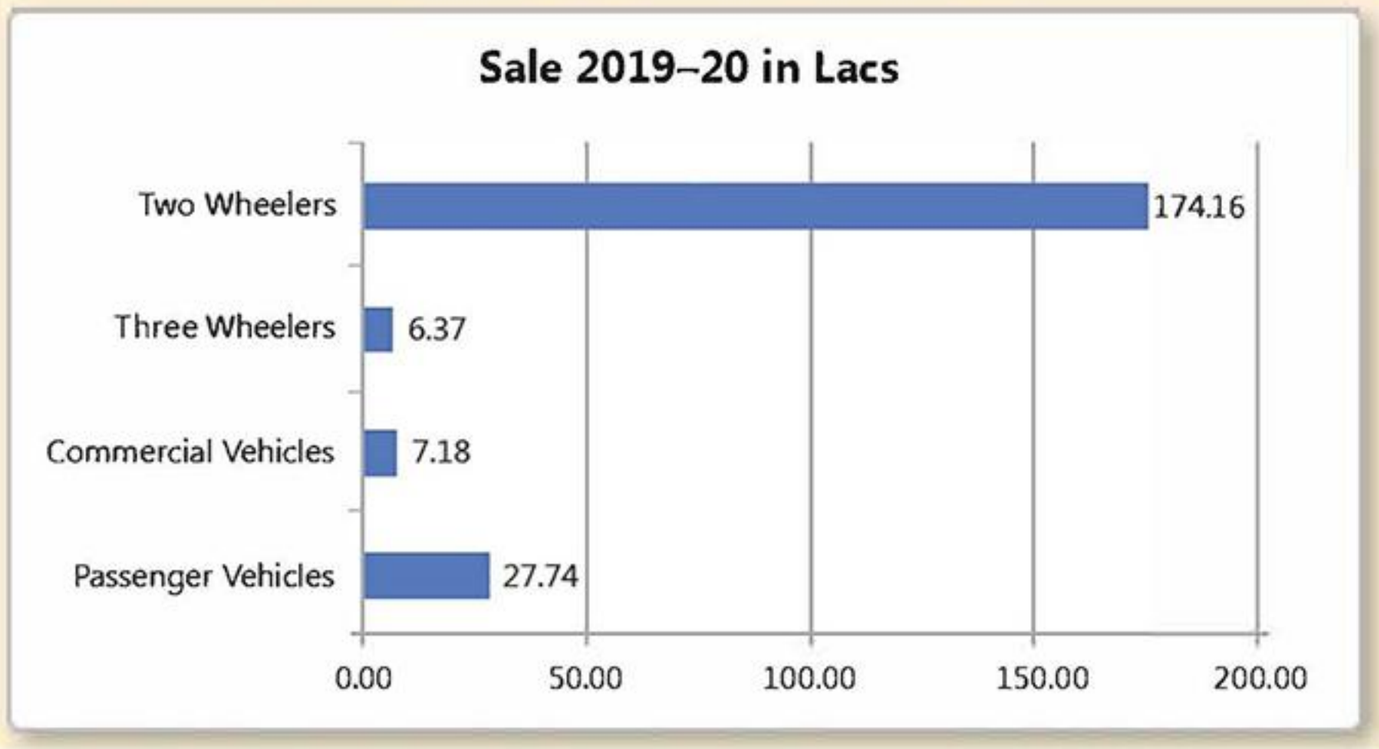
- **Microsoft Excel:** It is a manual data exploration tool provided by Microsoft. It provides different types of basic charts and objects for visualising data. However, it is limited to use only for representing small amounts of organised datasets. It is not preferable for big data.
- **Tableau Public:** It is free software allows us to create interactive data visualisations that we can share with others. It has very large datasets. It is one of the most commonly used data visualisation tools.
- **Microsoft Power BI:** It is a data visualisation tool provided by Microsoft. It is freely available to download and use.
- **Datawrapper:** It is one of the most commonly used data visualisation tools in media sector. It uses .CSV files to create charts and maps.
- **Google Data Studio:** It is a part of Google Marketing Platform and allows us to create multiple views of our data.

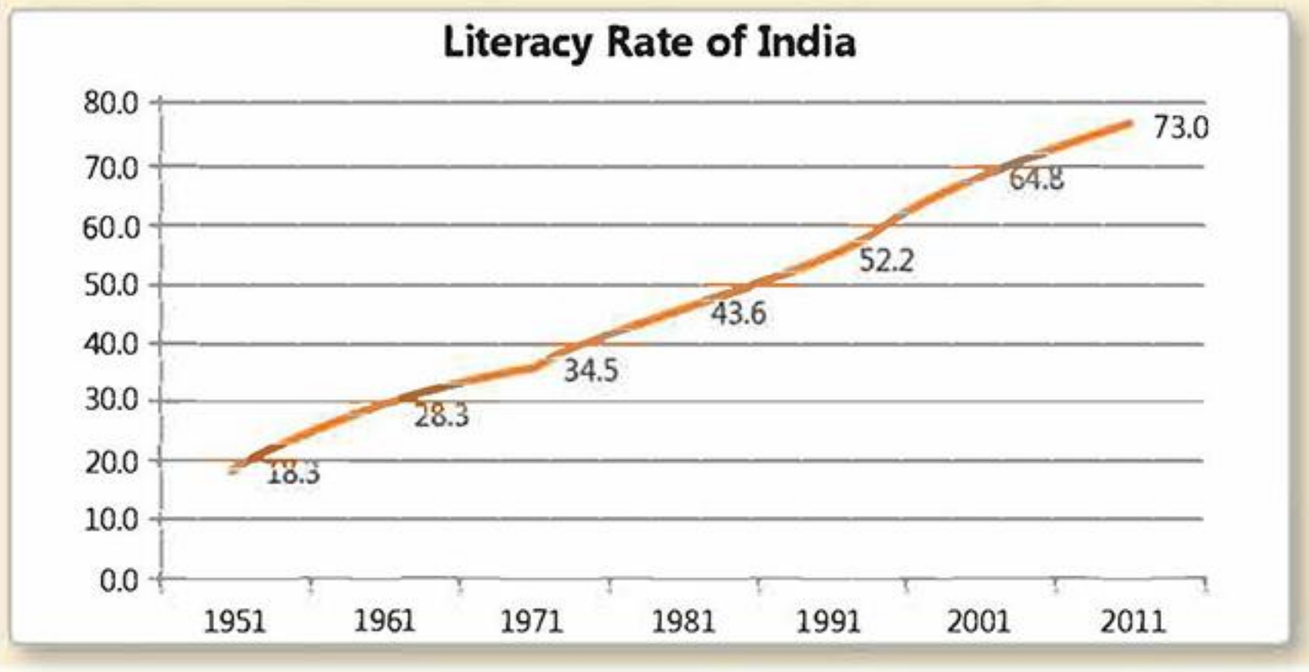
There are some other online websites also available for data visualisation. For example, https://datavizcatalogue.com

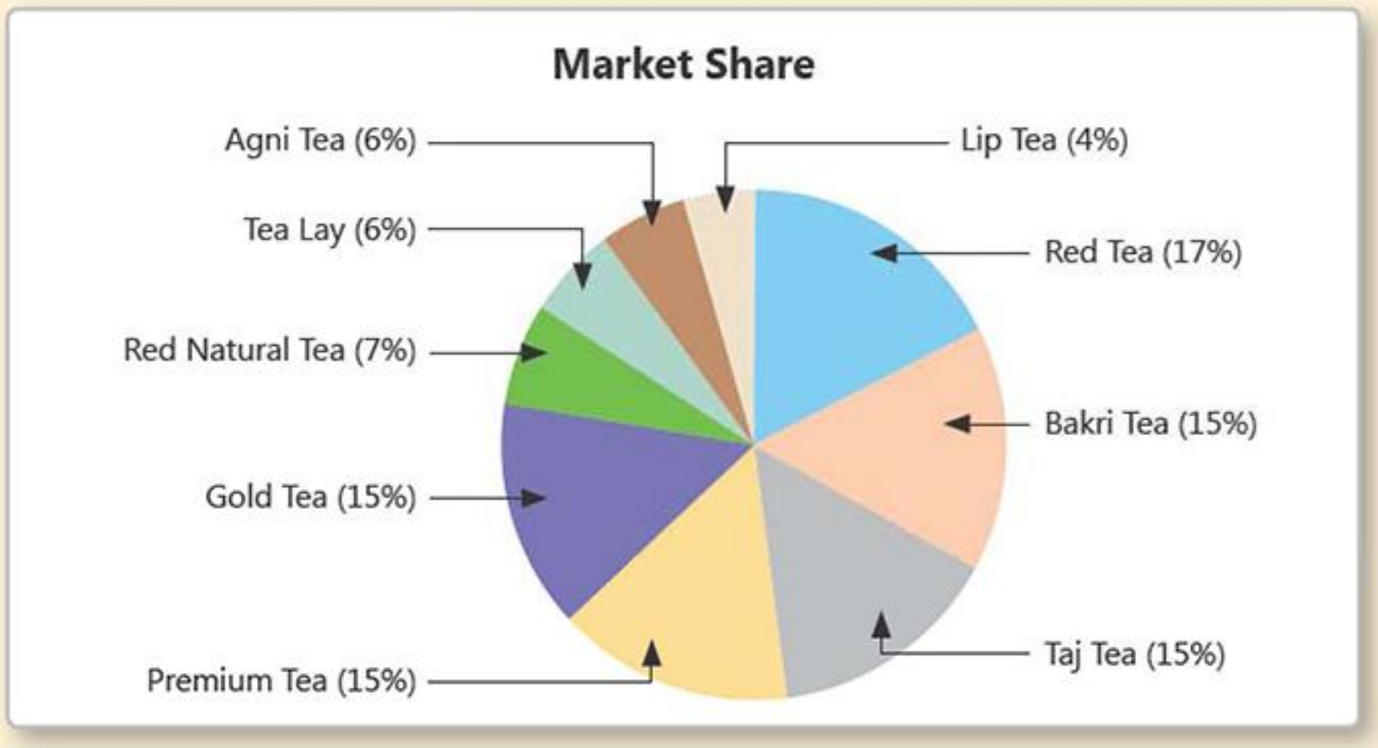
On this website, you will find various types of graphical representations and flowcharts.

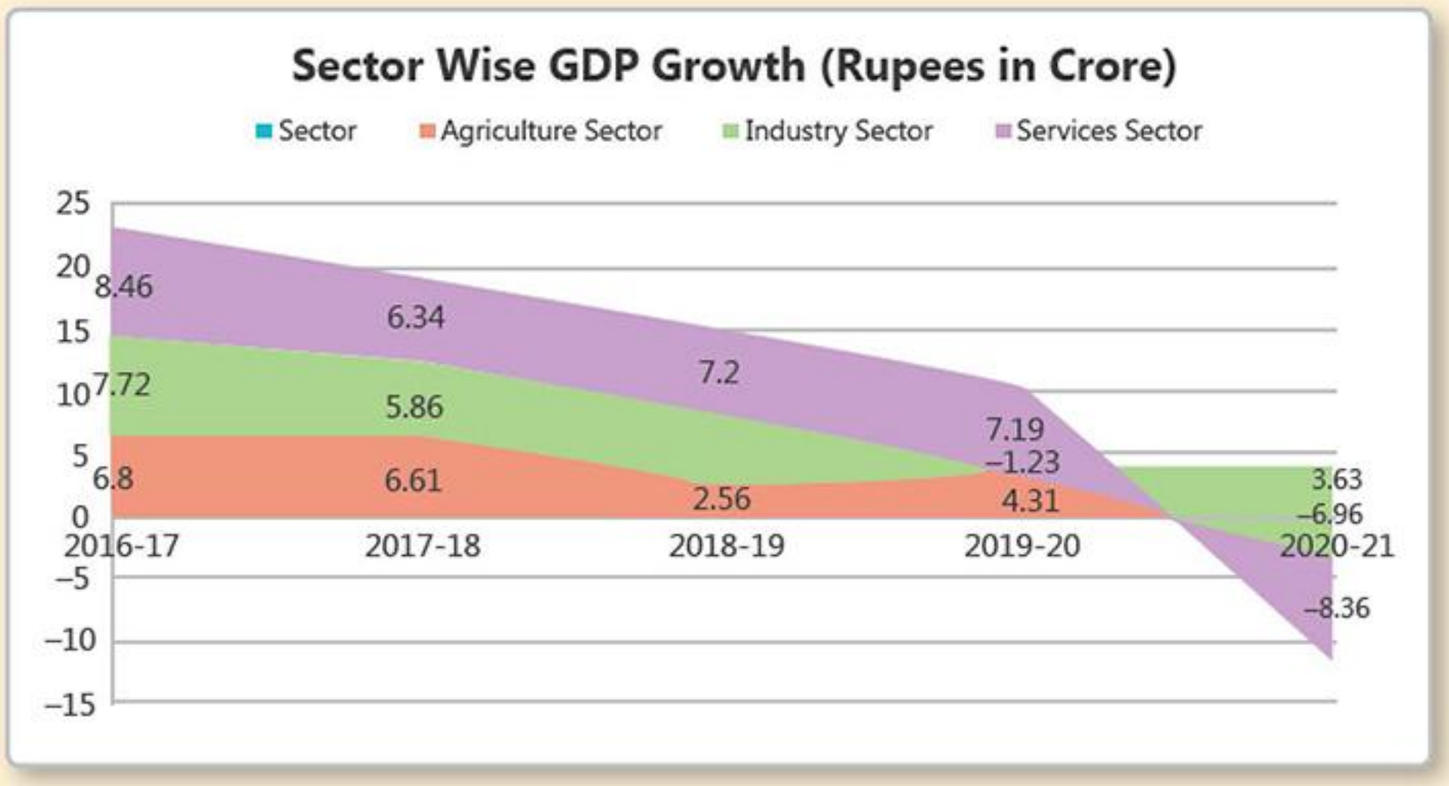
Different Ways to Visualise Data

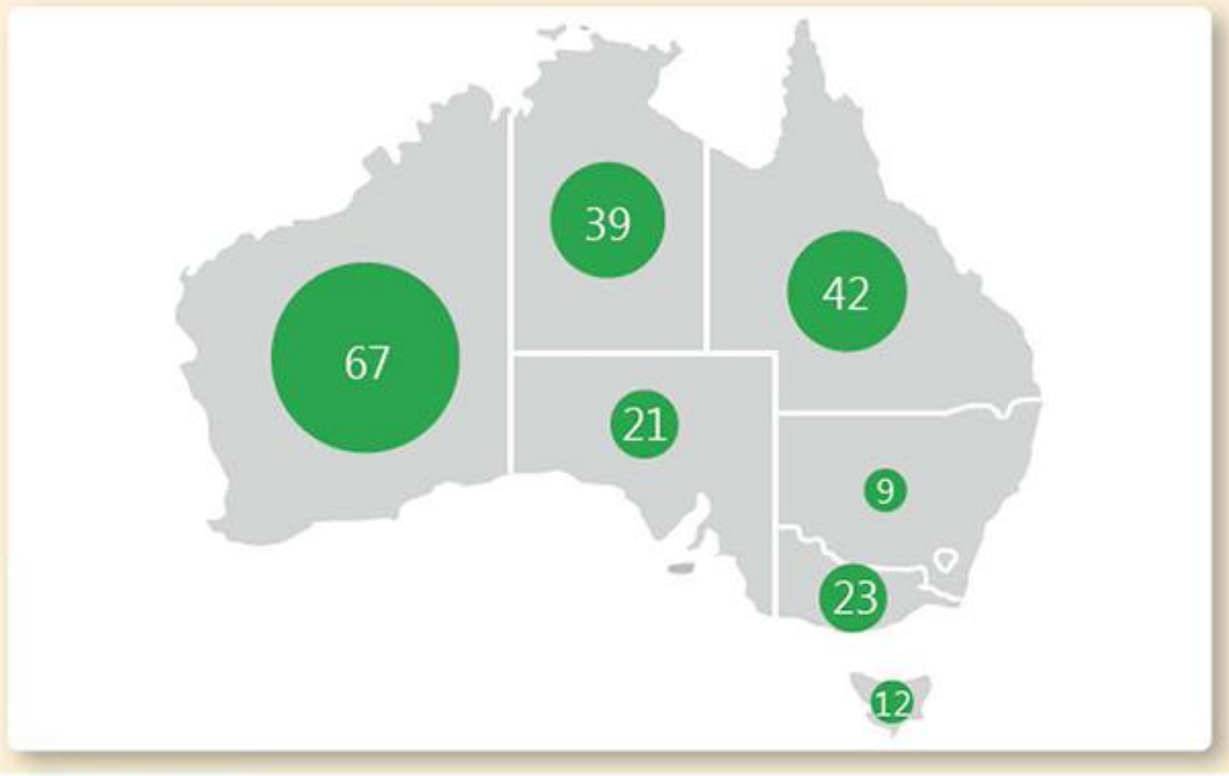
The following are the different ways to visualise data:

Data Visualisation Technique 1	
Name of the Representation	**Bar Chart**
Description	Graph that represents categorical data with rectangular bars with heights and length proportional to the values that they represent.
How to draw?	
Suitable for which type of data?	It is used to compare things between different groups or to track changes over time. For example, marks of 5 subjects to compare, rise in population in five years and changing fuel price every month.

Data Visualisation Technique 2	
Name of the Representation	**Line Chart**
Description	It is a graph that uses lines to connect individual data points. A line graph displays quantitative values over a specified time interval.
How to draw?	
Suitable for which type of data?	It is most suitable for continuous data to identify a trend or pattern in your data. For example, changing fuel price, daily profit earned by a shopkeeper, etc.

Data Visualisation Technique 3	
Name of the Representation	**Pie Chart**
Description	It is a circular representation of data where each slice shows the relative size of the data. The data is a complete circle equal to 360° with each slice forming a certain portion of the total (percentage).
How to draw?	
Suitable for which type of data?	Suitable for depicting percentage comparison between the different types of similar items. In this case, various brands of tea's market share are compared. For example, car varieties sold in a month, choices of most preferred market for shopping in a city, marks of students in class.

Data Visualisation Technique 4	
Name of the Representation	**Area Chart**
Description	It is an extension of the line chart with the areas under the line shown shaded.
How to draw?	
Suitable for which type of data?	It is used when you want to show a trend over time and make comparisons. For example, the most preferred food in a social gathering, most preferred show to watch in Netflix.

Data Visualisation Technique 5	
Name of the Representation	**Bubble Map**
Description	It is a combination of a bubble chart, data visualisation and a map. It is used to visualise location and proportion using circles over geographical regions with the area of the circle being proportional to its value in the dataset.
How to draw?	
Suitable for which type of data?	It is good for comparing proportions over geographic regions without the issues caused by regional area size. For example, showing the earthquake-prone areas in a country, the geographical distribution of whales in the northern hemisphere, number of tigers in the national parks of India.

AI Reboot

List down the 10 songs of your choice and make a spreadsheet containing the following information about each song:

S. No.	Song Name	Artist	Genre	Year	Song Length
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

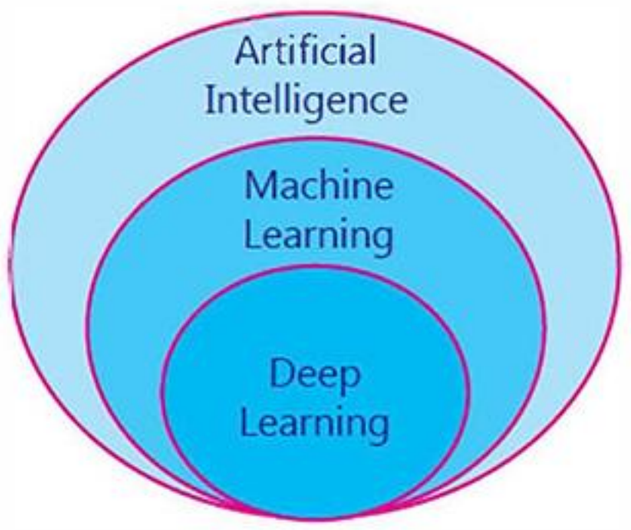
Identify the data feature in the collected data.
Create a different graph to understand the data effectively.

What is Modelling?

Modelling or data modelling is defined as the process of designing decision-making algorithms that have to be trained on a set of data (which was acquired at the data acquisition stage for the problem you scoped in the problem-scoping stage) and applying that learning to recognise certain types of patterns.

Once the data is visualised and trends are formed, we need to work with algorithms to prepare the AI model. This can be done by designing our models or using the existing AI models. Before we go into the details of modelling, let us first understand the following important terms:

- **Artificial Intelligence:** AI refers to any technique that enables computers to mimic or imitate, develop, and demonstrate human intelligence. They are machines that can perform tasks that they are programmed for. AI enables machines to think without any human intervention.
- **Machine Learning:** Machines need to learn the ways of humans by learning the techniques and processes. So machine learning is a subset of artificial intelligence that uses statistical methods that enable machines to improve with experiences. So machines learn from their mistakes and take them into consideration in the next iteration, this way they keep improving with experience. For example, Snapchat filters and Netflix recommendations.
- **Deep Learning:** Machines can draw meaningful inferences from large volumes of datasets. In deep learning, the machine is trained with a huge amount of data, which helps it train itself. Deep learning is a machine learning algorithm that is inspired by the functionality of our brain cells called neurons. For example, Google Translate and image recognition in social media apps.



Artificial intelligence is an umbrella term that includes machine learning and deep learning. Deep learning follows a specific learning approach, which is a subset of machine learning comprising multiple machine learning algorithms.

Let us understand the difference between artificial intelligence, machine learning and deep learning.

Artificial Intelligence	Machine Learning	Deep Learning
It aims at making a machine that mimics human intelligence.	It aims at making a machine that can learn through data and solve complex problems.	It aims at building neural network that can help in discovering patterns or trends.
It is a subset of data science.	It is a subset of AI.	It is a subset of machine learning.
It is the simulation of intelligence in machines.	It is the training of machines to take decisions with experience.	It is the process of using artificial neural networks for solving complex problems.
Examples: Robotics, natural language processing, computer vision, expert systems, etc.	Examples: Decision trees, random forests, support vector machines, neural networks, etc.	Examples: Convolutional neural networks (CNNs), recurrent neural networks (RNNs), generative adversarial networks (GANs), etc.

Data Modelling Techniques

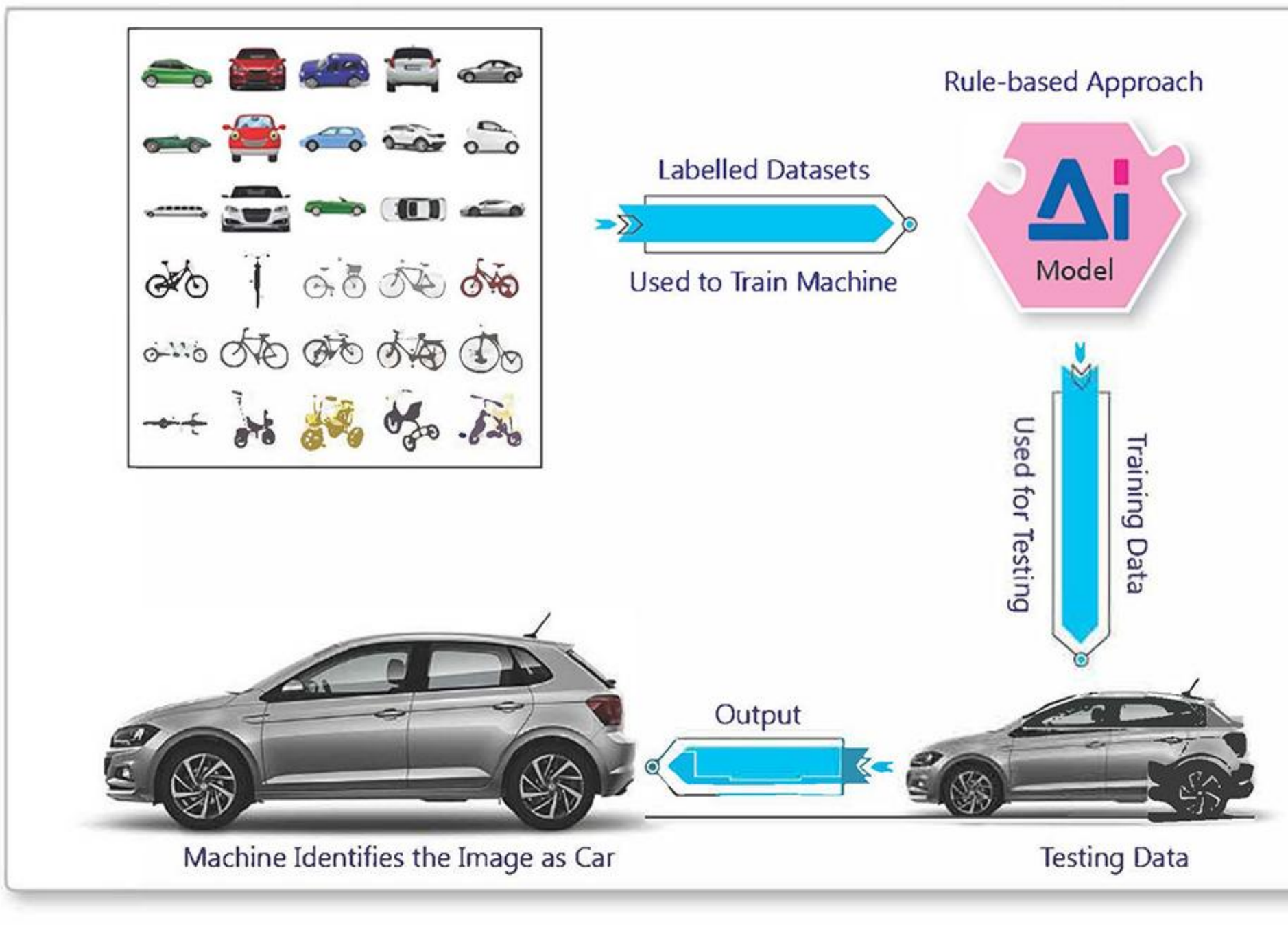
In AI modelling, we develop different algorithms called models, which can be trained to produce intelligent output. In other words, we write code to make a machine artificially intelligent.

AI modelling techniques can be broadly classified into two approaches, namely, rule-based and learning-based. Let us learn about them in detail.

Rule-Based Approach

Rule-based approach is based on a set of rules and set of facts already fed to the machine to generate the desired output. These models can operate with simple basic information and data. The relationships or patterns in the data is defined by the developer.

To explain it further, let's take an example. You have a dataset comprising 100 images of cars and 100 images of cycles. To train your machine, you feed this data and label each image as either a car or a cycle. Now if you test the machine with an image of a car, it will compare with the trained data and according to the labels of the trained data it will identify it as a car. This is called a rule-based approach. The rules given to the machine in this example are the labels assigned to the training data.

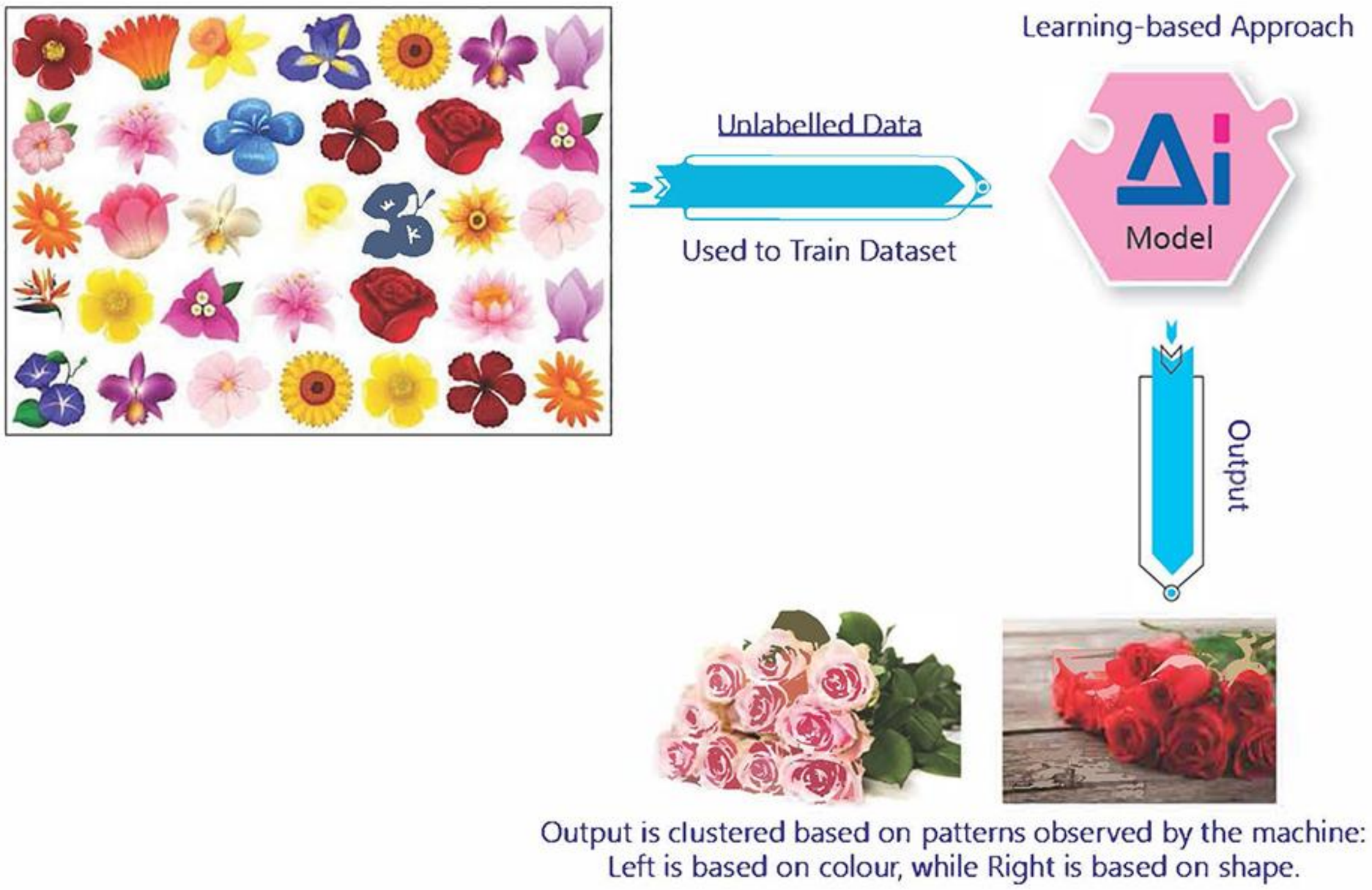


Learning-Based Approach

Learning-based approach refers to a model where the relationships or patterns in the data are not explicitly defined by the developer. In this approach, random data is fed into the machine and the machine develops its pattern or trends based on the data outputs. It is an alternative method to address some of the challenges of rule-based systems.

This approach is typically followed when the dataset fed to the machine is unlabelled and too random. The machine tries to extract similar features and clusters them in the same datasets. In the end, the machine tells the trends which are observed in the training data.

For example, suppose you have a dataset of 1000 images of flowers in your garden. Without any additional information about the flowers such as names, colours, or other features, it would be challenging to discern any patterns in this dataset. By employing a learning-based approach with an AI model, the machine could discover various patterns based on the features of these 1000 images. It might cluster the data based on colour, size, shape, etc. It might also come up with some very unusual clustering algorithm, which you might not have even thought of!



Output is clustered based on patterns observed by the machine:
Left is based on colour, while Right is based on shape.

Decision Tree—Rule-based Approach

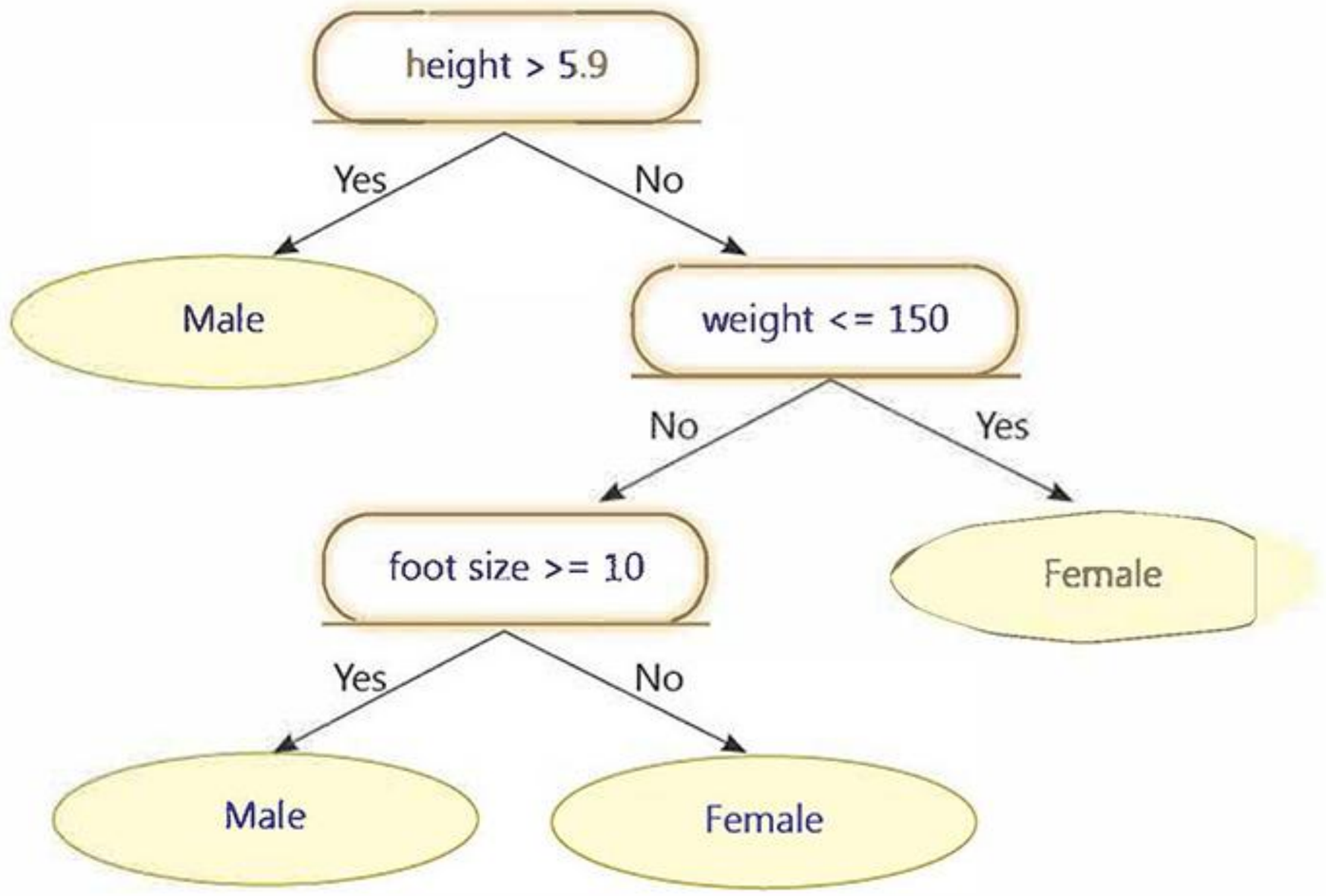
Decision trees are tools that follow a rule-based approach that uses a tree-like model of decisions and their possible consequences. It is a kind of flow chart, where the flow starts at the root node and ends with a decision made at the leaves. It is used to depict conditions and their outcomes. It is one of the most widely used and practical methods for supervised learning.

The decision tree starts from the **root node** just like the structure of a tree with two different ways or conditions: Yes or No. The forks or diversions are known as **Branches** of the tree. The branches either lead to another **decision/ question node** or they lead to another condition for decision, which is known as the **leaf node**. If you look closely at the image, it looks like an inverted tree with roots above and leaves below. That's why it's called the decision tree.

So let's revise some important terms related to the decision tree:

- **Root node:** A root node is the first node of a decision tree and it represents the entire set of data.
- **Branching:** Dividing the node at one level into two or more sub-nodes at the next level.
- **Decision node:** Dividing a node further into another level sub-node.
- **Leaf node:** A node that does not split further.
- **Parent node:** A node that is a level above a sub-node.
- **Child node:** A sub-node that falls under another node.

Let us understand about decision trees with the help of an example, where you need to identify the person is male or female based on the height, weight, and foot size.



Following are some of the important points to consider while designing a decision tree:

- There can be a possibility of multiple decision trees that lead to correct prediction for a single dataset. The simplest one should be chosen.
- The dataset might contain redundant data at times, which does not have any reference while creating a decision tree. Therefore, only those parameters that affect the output directly must be included.
- While making decision trees, one should take a look at the dataset given to them and try to figure out what pattern the output leaf follows. Try selecting any one output and on its basis, find out the common links that all the similar outputs have.

Ai Task

#Experiential Learning

1. The following is a dataset comprising 4 parameters which lead to the prediction of a student choosing a Science stream in senior secondary school. Make a decision tree for this dataset:

Aptitude	Logical Skills	Analytical Skills	Reasoning	Stream Selection: Science
High	High	High	High	Yes
High	Low	Low	Low	No
Low	High	High	High	Yes
Low	Low	Low	High	No
Low	High	High	Low	No

2. Make a decision tree to choose a book from the library based on the following selections.

   Choice 1: Fiction—Sci-Fi, Mystery, Classics.

   Choice 2: No Fiction—Travel Diaries, Autobiographies, History, Travelogues.

3. Using the given data, create a Decision Tree to help spot the elephant! Classify the animals based on the following characteristics:

   Choice 1: Large size and long trunk.

   Choice 2: Not large size and no trunk.

   Collaborate in your groups and present your Decision Trees!

Pixel It—Learning-Based Approach

In computer vision applications, understanding pixels, resolution, and megapixels is crucial for processing images.

The pixel is the smallest unit of digital images or displays. It is a tiny dot (smallest point) in a graphic image that stores colour and intensity details. Pixels work together to create the graphic that you view on your screen.

Resolution refers to the clarity or sharpness of a picture or text seen on the display. It is the total number of pixels (tiny dots) that comprise the display. A higher resolution involves more pixels, which leads to an improved and more accurate image.

The term megapixel refers to the resolution of digital cameras and camera sensors. It indicates one million pixels. For example, a 16-megapixel camera can capture photographs with a resolution of about 4928 x 3264 pixels that contain approximately 16 million pixels.

Calculating the number of megapixels in an image involves a simple formula based on its resolution. The formula is:

$$\text{Megapixels} = \frac{\text{Width in pixels} \times \text{Height in pixels}}{1{,}000{,}000}$$

"Pixel It" is an example of a machine learning approach that is used in computer vision applications. The graphics or images created on computers are pixel-based images. It shows how the computer classifies the images and reads them.

Let us do an activity that helps us understand how the images are processed and classified by the computers.

Ai Task

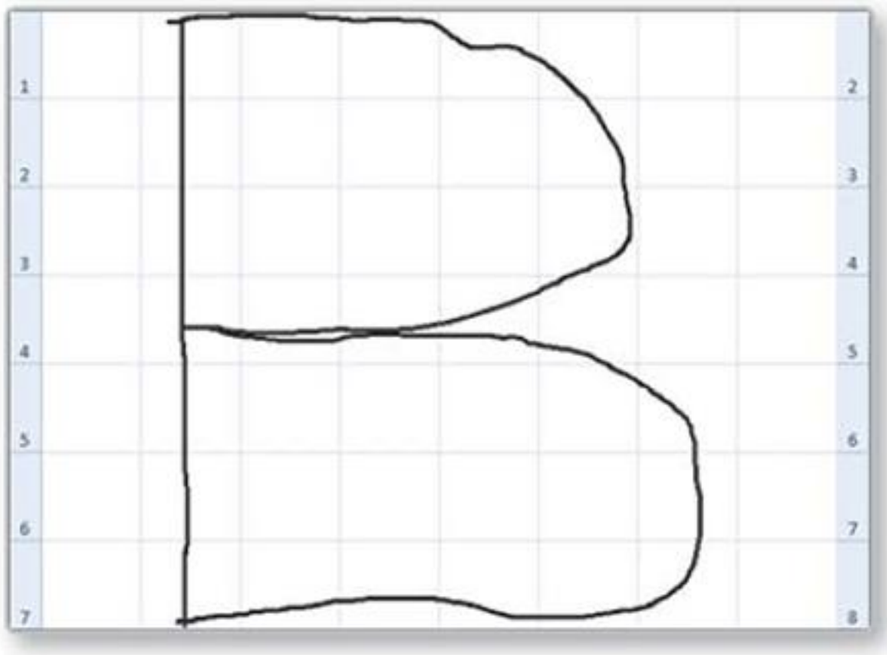
#Experiential Learning

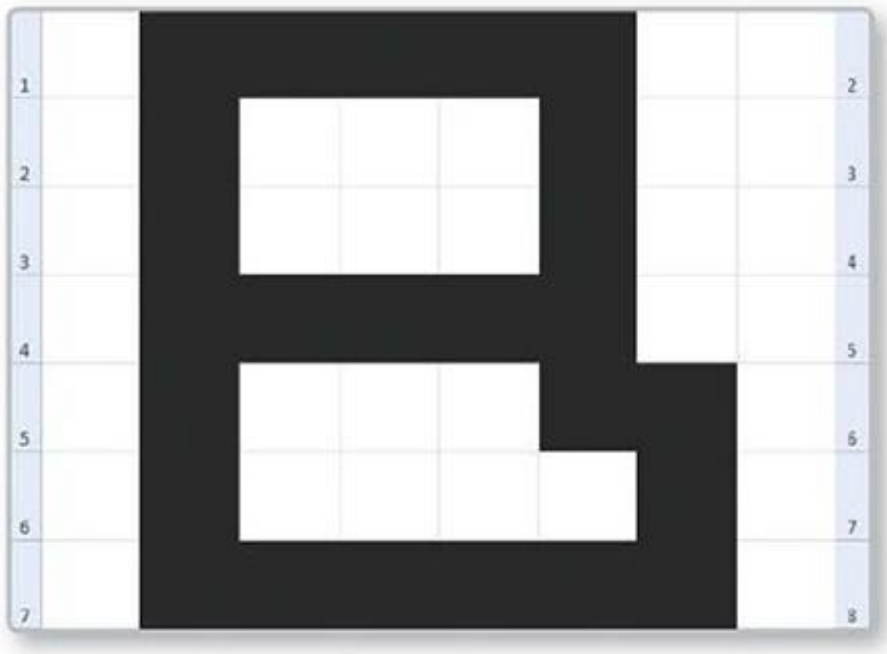
Let us start with an activity. Follow the instructions step-by-step, as mentioned below:

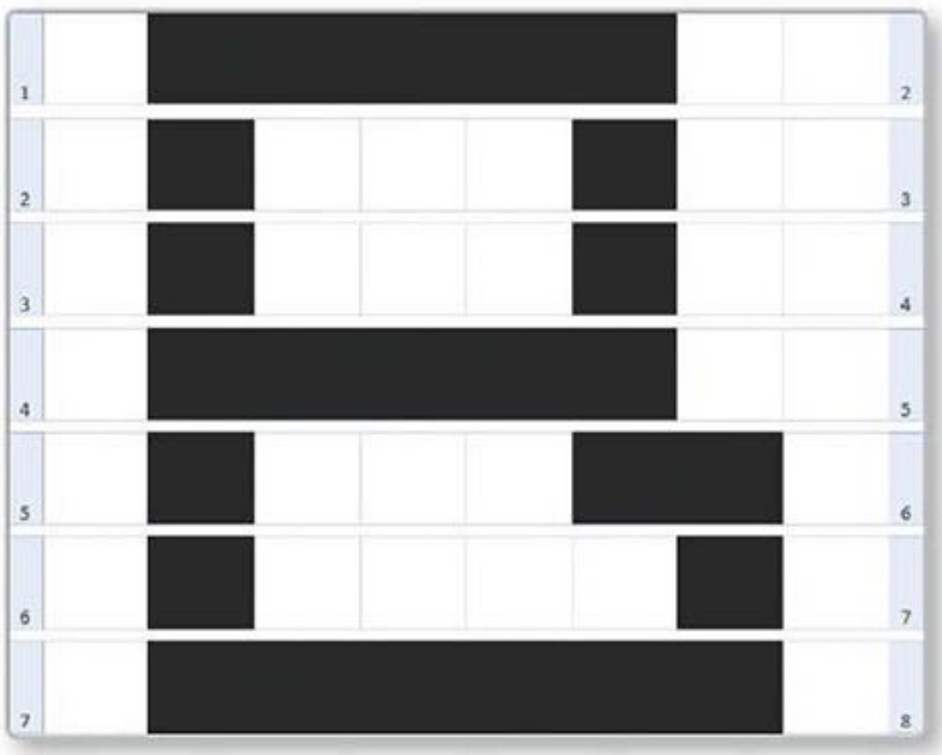
- Cut out the matrix from the page given below or draw the same on a blank page with 6x6 square blocks.
- Write an uppercase letter on this matrix. The height of the letter should be equal to the height of this matrix. In other words, it should start from the bottom line of the matrix to the top line. You can write any capital alphabet in any handwriting.
- Now, colour the boxes on which the lines of that letter have fallen.
- After this, cut out horizontal stripes of the matrix such that it goes from 1–2, 2–3, 3--4, 4–5, 5–6 and 6–7.
- Now, paste all these stripes together to form a single paper string. Make sure that neither the last block should be over the first block of the next line nor there should be any gap between the first and the last blocks.
- Now, find those students in your class who have chosen the same letter as you.
- Put their paper strings under your string and add up all the coloured blocks to get a series of numbers. A block without colour counts as 0, while the coloured ones count as 1. If a column has 3 coloured boxes, the summation turns out to be 3.
- Now, get another student whose letter is different from yours. Put his paper string under your multiple strings (of the same alphabet) and see if the pattern of coloured blocks is the same or not.
- Also, go to other groups and check if their summation series of numbers is the same as yours or not.
- Note down your observations in the end.

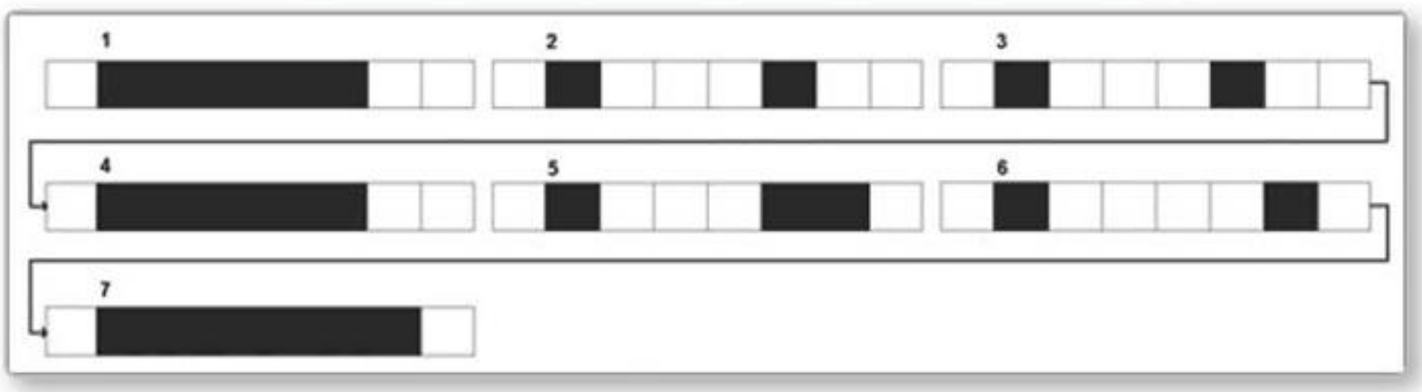
1							2
2							3
3							4
4							5
5							6
6							7

Cut this table









- Write an uppercase letter on this matrix. The height of the letter should be equal to the height of this matrix. In other words, it should start from the bottom line of the matrix till the top line. You can write any capital alphabet in any handwriting.
- Colour the boxes on which the lines of that alphabet have fallen, as shown in the above figure.
- Cut out horizontal stripes of the matrix such that they go from 1–2, 2–3, 3–4, 4–5, 5–6 and 6–7. Paste all these stripes together to form a single paper string. Make sure that neither the last block should be over the first block of the next line nor there should be any gap in between the first and the last blocks.

Ai Task

#Experiential Learning

An image has a resolution of 3264x2448 pixels. Calculate the number of megapixels in this image.

What is Evaluation?

Model evaluation is the stage of testing the model where testing data is given to the system and the output generated is evaluated with the actual result to see the accuracy of the output and the reliability of the AI model. There can be different evaluation techniques, depending on the type and purpose of the model.

Ai Reboot

1. Explain the term problem scoping in AI project Cycle.

2. Differentiate between data exploration and data acquisition.

Importance of Evaluation

Evaluation is a process that critically examines a program. It involves collecting and analysing information about a program's activities, characteristics, and outcomes. Its purpose is to make judgements about a program, to improve its effectiveness, and/or to inform programming decisions. Following are some of the advantages of evaluating an AI model:

- Evaluation ensures that the model is operating correctly and optimally.
- Evaluation is an initiative to understand how well it achieves its goals.
- Evaluations help to determine what works well and what could be improved in a program.

Model Evaluation Terminologies

Evaluation of an AI model can be done using various terminologies. Let us try to understand them with the help of a scenario.

Scenario: An AI-based prediction model is deployed in schools. The model is supposed to predict whether the students of grade 10 will be able to get a "Perfect Score" in the board exams this coming year or not. The model will check for whether the students will be able to score full marks in board exams in the coming year or not.

There are two important parameters that are used for the **Evaluation** of a model. These are:

Prediction: It is the output given by the AI model using a Machine Learning algorithm.

Reality: It is the real scenario of the situation for which the prediction has been made.

Let's look at the various combinations that can be considered for the above scenario.

Case 1: Is There a Perfect Score?

Due to coaching institutes and a lot of easy access to online resources, it is not clear whether this would work in their favour or not. Guidance and coaching are so readily available to all that most of them are prepared well for the exams, but it can also lead to tougher papers to test them well. This makes getting a perfect score unpredictable. We need an AI model that can predict whether the student can get a Perfect Score or not in the board exams so that the students can timely plan their preparation and schedule to study as per the exam schedule.

In the above picture, we show the possibility of students scoring full marks in board exams for grade 10. The model predicts a **Yes**, which means the student will get a Perfect Score in board exams to be conducted. The prediction matches with the reality: Yes, therefore, this condition is called **True Positive**.

Case 2: Is There a Perfect Score?

There is no Perfect Score as the Examination Paper was difficult, hence the **Reality** is **No**. In this case, the machine too has **predicted** it correctly as a **No**. Therefore, this condition is termed as **True Negative**.

Case 3: Is There a Perfect Score?

Here, the reality is that there are no Perfect Scores due to difficult papers. However, the machine has incorrectly predicted that there will be a Perfect Score for the students of grade 10. This case is termed as **False Positive**.

Case 4: Is There a Perfect Score?

Here, the reality is that there is a Perfect Score due to the hard work of students, the availability of online resources and the right guidance at the coaching institutes. However, the machine has incorrectly predicted that there will be no Perfect Score for the students of grade 10. This case is termed as **False Positive.**

Confusion Matrix

Confusion matrix is a tabular structure that helps in measuring the performance of an AI model using the test data. The table is made with 4 different combinations of predicted and actual values (reality) in the form of a 2×2 matrix. The comparison between the prediction and the reality can be used to analyse the rate of success. It also gives a clear picture of which cases are being predicted correctly and incorrectly, and what types of errors are being made.

This matrix is also known as the **Error Matrix** and is used in situations where we need to evaluate the performance of the model, where it went wrong and helps us find ways to increase the efficiency of the model. It is useful for measuring recall, precision, accuracy and F1 score.

The following confusion matrix table illustrates how the 4-classification metrics are calculated (TP, FP, FN, TN), and how our predicted value is compared to the actual value in a confusion matrix.

Confusion Matrix		**Reality**	
		Yes	No
Prediction	Yes	True Positive (TP)	False Positive (FP)
	No	False Negative (FN)	True Negative (TN)

In the confusion matrix:

- The target variable has two values: **Positive** and **Negative.**
- The **columns** represent the **actual values** of the target variable.
- The **rows** represent the **predicted values** of the target variable.

For example:

In schools, a lot of times it happens that there is no transport facility available to commute. The unavailability of school transport is a very common and prominent problem. Hence, an AI model is designed to predict if there is going to be school transport available or not.

The confusion matrix for the same is:

Confusion Matrix		**Reality**	
		Yes	No
Prediction	Yes	22	12
	No	48	18

Ai Reboot

1. Differentiate between prediction and reality.

2. What is error matrix?

ROC Curve

The Receiver Operating Characteristic (ROC) curve is a graphical representation that illustrates the performance of a binary classifier system at varying threshold values. It plots the True Positive Rate (TPR) against the False Positive Rate (FPR) at various threshold settings.

This curve plots two parameters:

- **True Positive Rate (Sensitivity)** is the proportion of actual positive cases that are correctly identified by the classifier.

$$TPR = \frac{TP}{TP + FN}$$

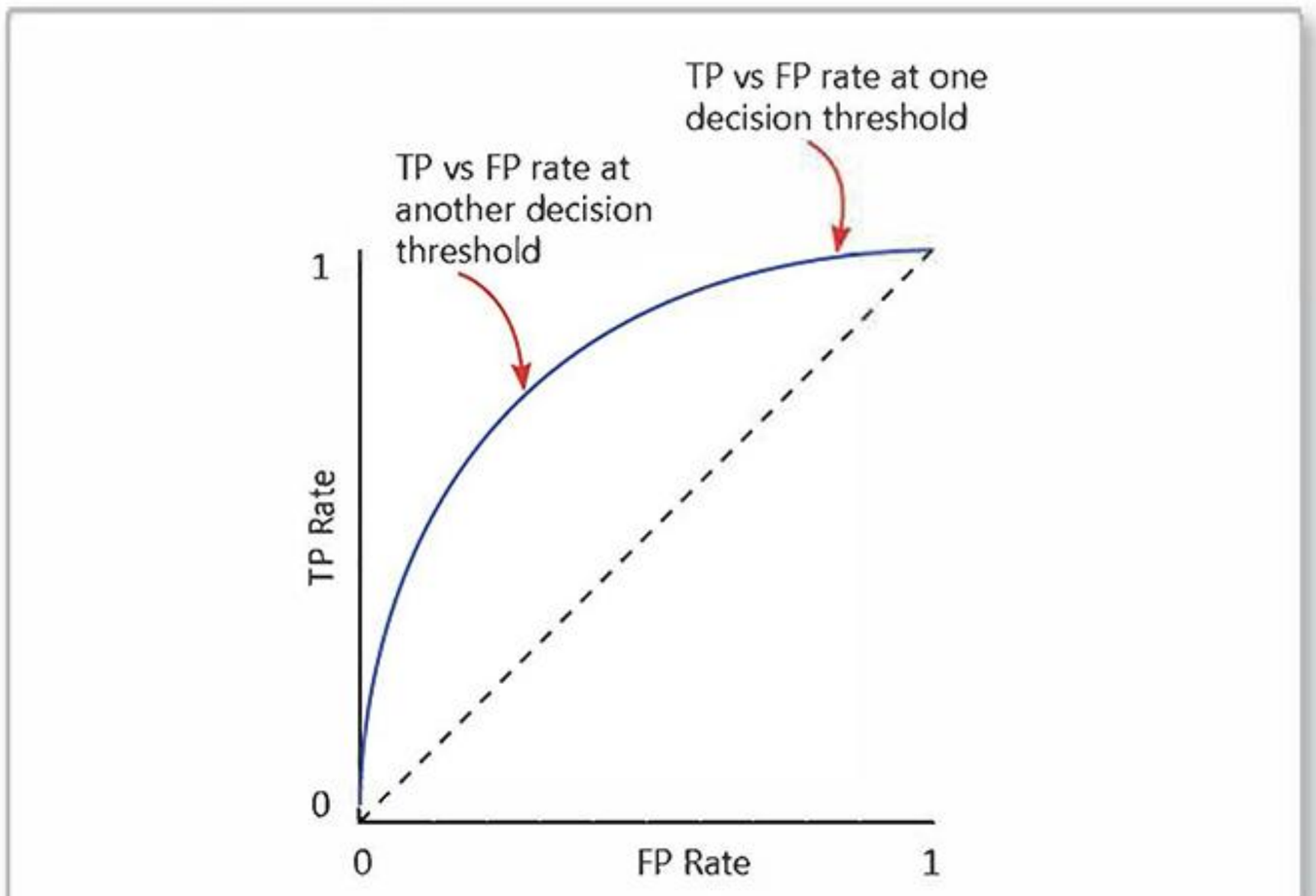
- **False Positive Rate** is the proportion of actual negative cases that are incorrectly classified as positive.

$$FPR = \frac{FP}{FP + TN}$$

To generate an ROC curve, you need to perform the following tasks:

- Vary the threshold of your classifier, usually ranging from 0 to 1, and calculate TPR and FPR at each threshold.
- Plot these TPR and FPR values on a graph. TPR is plotted on the y-axis, and FPR is plotted on the x-axis.

Lowering the classification threshold classifies more items as positive, thus increasing both false positives and true positives. The following figure shows a typical ROC curve.

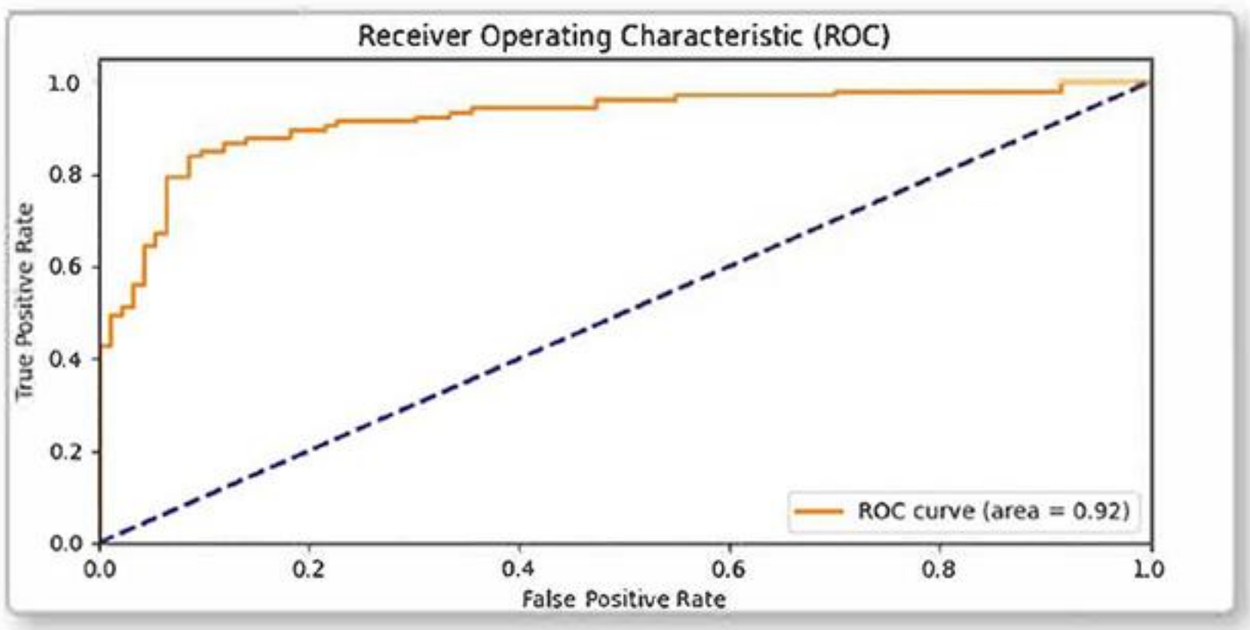


Evaluate: Exoplanet Use Case

At this particular stage, we may need to evaluate the model to find out the accuracy of the model that makes the best prediction.

ROC is a metric that is used to find out the accuracy of the model.

Figure shows the accuracy of the model using ROC curve.



What is Deployment?

The deployment phase is the last stage of the AI project cycle and is used when the AI model is put into use in a real-world setting. This involves integrating the model into existing systems or applications, such as creating Application Programming Interfaces (APIs) or embedding it directly into software. It also includes setting up the necessary infrastructure, like servers or cloud services, to support the model. Once integrated, the model needs to be able to process new data and provide predictions. Monitoring tools are established to track the model's performance and ensure it works correctly. Logging and reporting are also important to capture data on how the model is performing and to identify any issues that might arise. This phase is crucial for making the AI model functional and useful for end-users.

Deployment of an AI project is an essential phase in bringing the created AI solution into practical use. The following are some of the primary reasons why AI project deployment is relevant:

- Deployment converts theoretical models into actual tools that are capable of being used in real-world circumstances, bringing the AI solution into practice.
- By deploying the AI solution, organisations may assess its success, productivity, and relevance in real-world scenarios.
- Deployment is required for end users to communicate with the AI solution.
- Deployment enables the AI solution to grow and be implemented in a variety of situations or places.
- Deployed AI solutions can provide considerable social and financial advantages by increasing productivity, lowering costs, and efficiently tackling crucial concerns.

The deployment process for AI models involves several key steps:

1. **Validating and testing the AI model:** This phase ensures the performance of the AI model in real-world situations that meet the expectations. This involves evaluating the accuracy, performance, and reliability of the AI model.
2. **Integration with current systems:** After testing and validating the AI model, it must be integrated with the existing systems and infrastructure of the organisation by linking the AI model to data sources, APIs, and other software systems.
3. **Monitoring and maintaining the deployed AI model:** After deployment, it is necessary to track the performance of the AI model to guarantee it remains effective. Monitoring and maintaining the deployed AI model includes various tasks, such as evaluating its performance, identifying and fixing any errors, and upgrading the model if required.

Some examples of successful AI projects that have been deployed in various industries include as self-driving cars, medical diagnosis systems, and chatbots.

Case Study: Preventive Blindness

Problem: Prevent Loss of Vision and Delay in Report Generation

Diabetic Retinopathy (DR) is a severe complication of diabetes that affects the blood vessels in the retina. This condition can lead to blurred vision and eventually blindness if not detected and treated promptly. Given that approximately 537 million adults aged 20-79 are living with diabetes, addressing the timely detection of DR is crucial. However, the lack of qualified doctors and delays in generating medical reports exacerbate the risk of undiagnosed and untreated Diabetic Retinopathy.

Symptoms

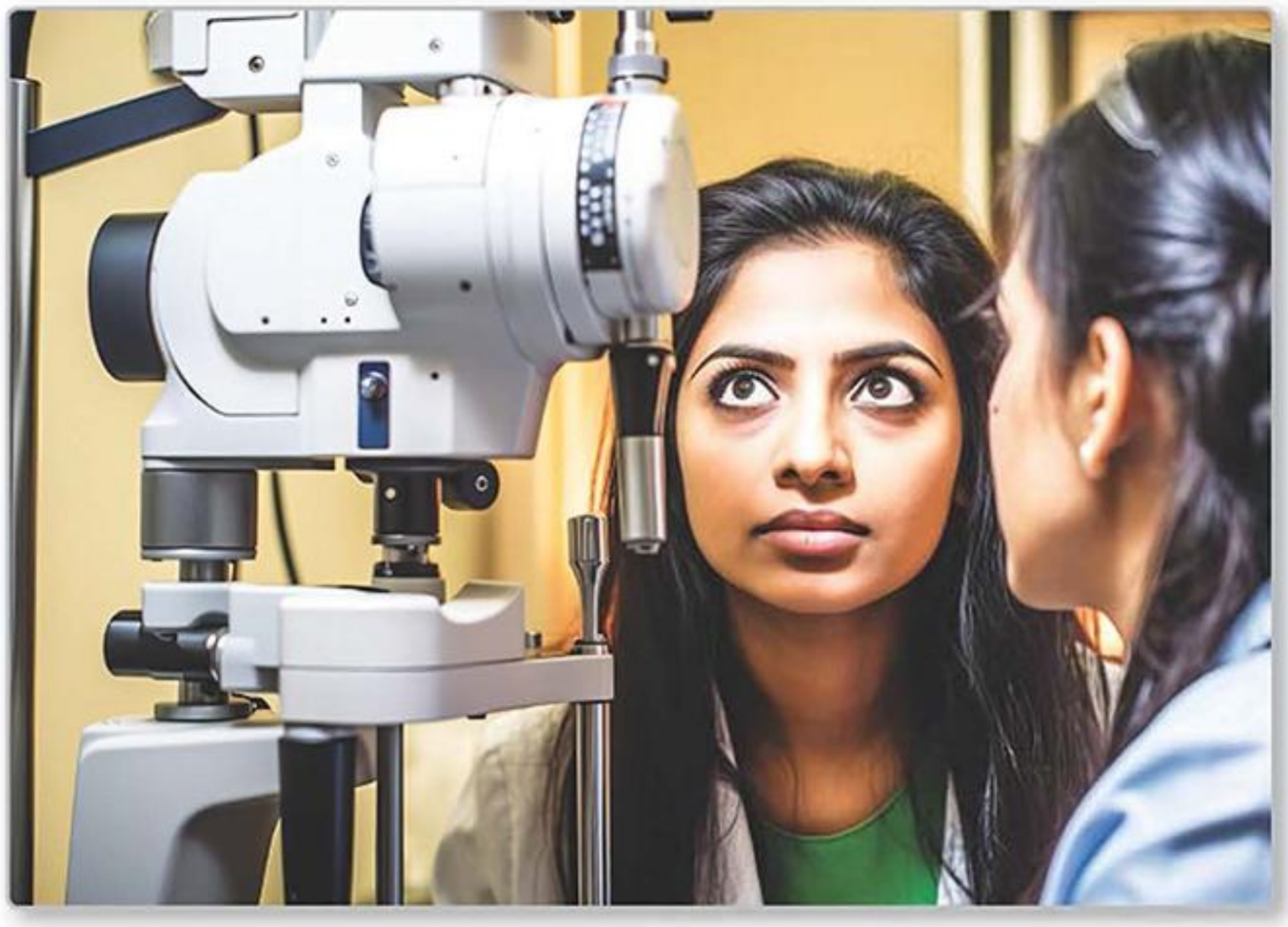
An early sign of Diabetic Retinopathy is blurred vision. Below is a comparison:

Normal Vision

Blurred Vision

Solution

To tackle this challenge, Aravind Eye Hospital in India has implemented an AI-driven solution in partnership with Google. This initiative leverages advanced AI models to accurately and quickly detect Diabetic Retinopathy in patients.



AI implementation for detecting diabetic retinopathy:

- **Collaboration:** The AI eye screening solution was developed in partnership with Google.
- **Accuracy:** AI models have reached an impressive 98.6% accuracy in detecting Diabetic Retinopathy, on par with specialist eye doctors.
- **Deployment:** Seventy-one vision centers in rural Tamil Nadu, India are utilising this AI technology.

Procedure

Trained technicians capture high-quality images of patients' eyes using specialised cameras.

The AI system analyses these digital images to identify the presence of Diabetic Retinopathy.

This approach accelerates the detection process and ensures timely diagnosis.

Technicians can operate the AI system without the need for a skilled doctor, making it accessible in rural areas.

Benefits

The AI-driven solution significantly benefits rural populations by enabling early detection and treatment of Diabetic Retinopathy. This reduces the risk of severe vision loss.

#Digital Literacy

Video Session

Watch the video given below "Deploy and fine-tune large AI models with your data".

Visit: https://www.youtube.com/watch?v=5y0xiHUKBW4 or scan the QR code and understand how the AI Project is deployed and fine-tuned.

Scan the QR code or visit the given link to watch the video, "Deploy and fine-tune large AI models with your data"

https://www.youtube.com/watch?v=5y0xiHUKBW4

Scan the QR code or visit the given link to watch the video, "*AI-Powered Pest Management for Cotton Farmers*"

https://www.youtube.com/watch?v=LP_A4jydmz4

AI Project Cycle Mapping Template

AI Project Cycle Mapping Template presents how different stages are related to each other and how the functions performed in every phase forms an input for the next phase.

The performed task at one stage forms the root for the next stage.

AI Project: Customer churn prediction (identifying at-risk customers who are likely to cancel their subscriptions or close/abandon their accounts.)

- **Problem Scoping**
  - ✶ **Identify the problem:** The telecommunications company wants to reduce customer churn rates.
  - ✶ **Define objectives:** Develop a predictive model to identify customers at risk of churning.
- **Data Acquisition**
  - ✶ **Gather data sources:** Collect customer demographics, usage patterns, service history, and churn status data from the company's databases.
  - ✶ **Ensure data quality:** Clean the data, handle missing values, and remove duplicates.
- **Data Exploration**
  - ✶ **Explore the data:** Analyse customer demographics, usage patterns, and churn rates through visualisations and statistical summaries.

    * **Preprocess data:** Simplify numerical features, convert categorical variables, and create new metrics like customer tenure.
- **Modelling**
    * **Select techniques:** Choose machine learning algorithms suitable for classification tasks, such as logistic regression, decision trees, and random forests.
    * **Train models:** Use the prepared data to train multiple models, adjusting hyperparameters and performing cross-validation to optimise performance.
- **Evaluation**
    * **Evaluate models:** Assess the performance of each model using metrics like accuracy, precision, recall, and F1-score.
    * **Compare models:** Compare the performance of different models to select the best-performing one for deployment.
- **Deployment**
    * **Deploy model:** Integrate the selected model into the company's customer management system to predict churn risk for new customers.
    * **Monitor performance:** Monitor the model's predictions in real-time, track churn rates, and gather feedback from customer service interactions.

In this example, each phase of the AI project cycle builds upon the outputs of the previous phase:

AI Project Cycle Mapping Template					
Problem Solving	**Data Acquistion**	**Data Exploration**	**Modelling**	**Evaluation**	**Deployment**
The telecommunications company wants to reduce customer churn rates.	Gather customer demographics, usage patterns, service history, and churn status data from company databases.	Analyse customer demographics, usage patterns, and churn rates with visualisations and statistical summaries.	Select machine learning algorithms for classification, like logistic regression, decision trees, and random forests.	Evaluate each model's performance using accuracy, precision, recall, and F1-score.	Integrate the model to predict new customer churn risk.

- **Problem Scoping:** States the problem that needs attention.
- **Data Acquisition:** Data acquisition consists of two words: Data and Acquisition. Data refers to the raw facts, figures, information, or statistics; where as, acquisition refers to acquiring data for the project.
- **Data Exploration:** It is the first step of data analysis that is used to visualise data. It generates insights that are used to inform modelling decisions.
- **Modelling:** Develops predictive models based on insights gained from data exploration.
- **Evaluation:** Assesses model performance by feeding the data into the model and comparing the output with the actual answers. It is used to determine the best model for deployment.
- **Deployment:** Integrates the selected model into the company's systems for real-world usage.

The feedback loop continues as the deployed model's performance is monitored, and insights gathered are used to refine future iterations of the AI solution.

Ai Task

#Problem Solving & Logical Reasoning

Activity: Implementing the AI Project Cycle for Personalised Education

Objective

Students will apply the AI project cycle to design a personalised education solution. For this, they use the 6 steps of the AI project cycle.

Description

- Individuals have unique thinking levels and personalities.
- Different learners require targeted attention in various areas of their education.
- A generalised education system cannot meet these individual needs.

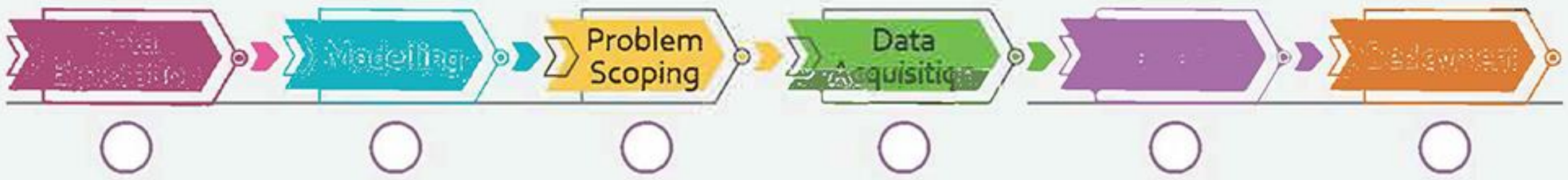
Steps to perform

1. **Understand the problem:**
   * Discuss how a one-size-fits-all education system fails to address the diverse needs of students.
   * Identify the specific challenges students face in a generalised education system.
2. **Explore developments in the field:**
   * Research advancements in AI that address personalised learning.
   * Study existing AI models used in education and their impact.
3. **Complete the AI Project Cycle Mapping Template:**
   * Fill out each step of the AI project cycle with respect to the problem of personalised education.

AI Project Cycle Mapping Template					
Problem Solving	**Data Acquistion**	**Data Exploration**	**Modelling**	**Evaluation**	**Deployment**

Ai Reboot

Write the correct sequence number below every stage according to the AI project cycle:



AI Ethics

Ethics are rules about what is right and wrong. AI ethics are rules about using artificial intelligence (AI) in a good way. As the use of AI increasing, companies are creating rules called AI codes of ethics.

An AI code of ethics is a set of rules that says how AI should be used to help people. These rules allow people make good decisions when using AI.

Some of the AI ethics that you need to follow while working on an AI model are:

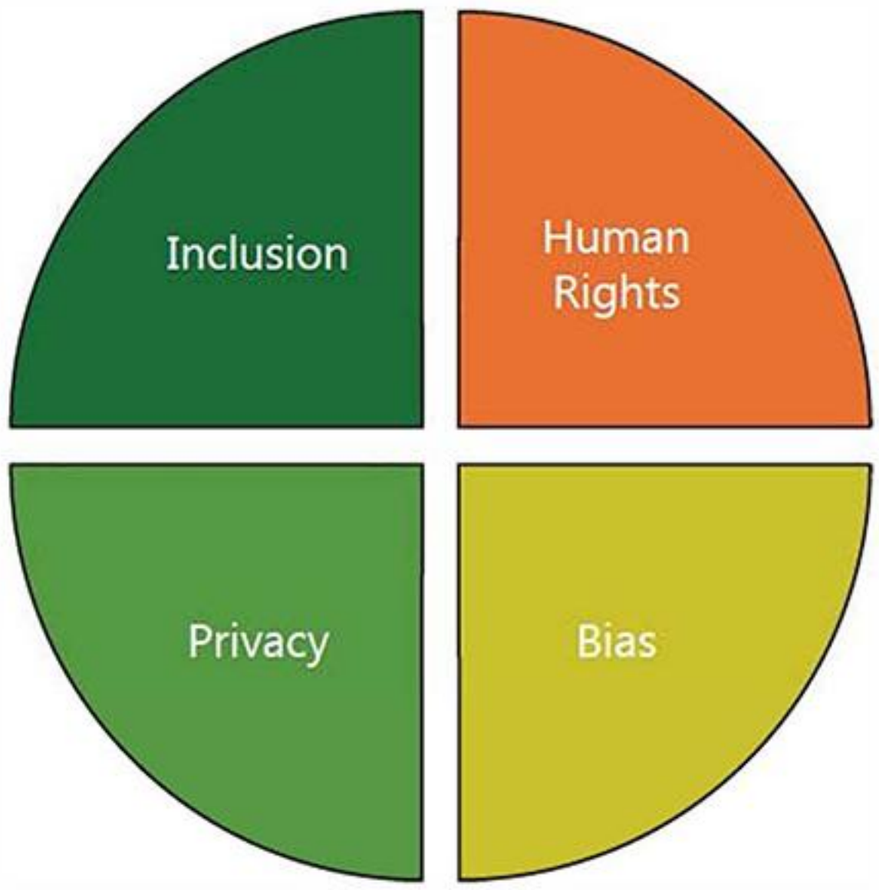
- Model should be understandable by all.
- Every aspect of the model should be self-explanatory and transparent.
- Covering all the sections of the population is important.
- Countercheck and validate all the assumptions taken and the results.
- Keep a watch on the functioning and working of your system, as something can go wrong and timely detection of the same is important.
- Also, fix the responsibility and set the accountability.

Ethics and Personal Data

Ethics play a crucial role in handling personal data, focusing on privacy, consent, transparency, and data security. Privacy ensures that individuals' personal information is respected and protected, requiring organisations to collect, use, share, and process data in ways that maintain confidentiality. Consent involves obtaining clear and explicit permission from individuals before collecting, sharing, processing, or using their data, ensuring they are informed about how their data will be used and giving them the option to withdraw consent. Transparency means being open about data collection practices, clearly communicating what data is collected, how it is used, stored and analysed, and who it is shared with. Data security involves implementing strong measures to protect personal data from unauthorised access, breaches, and other threats, ensuring the integrity and safety of the information. These ethical principles help build trust and ensure responsible data management.

What are the Principles of AI Ethics?

Ethics in AI encompasses the moral principles, values, and guidelines that govern the development, deployment, and use of artificial intelligence systems.



- **Human rights:** This principle emphasises that AI solutions should respect, protect, and uphold fundamental human rights. This includes rights such as privacy, freedom of expression, freedom from discrimination, and the right to a fair trial. AI systems should be designed and implemented in a way that they do not infringe upon these rights and should be held accountable if they do.
- **Bias:** Bias in AI refers to the unfair or unjust treatment of individuals or groups based on characteristics such as race, gender, age, or socioeconomic status. Bias can be unintentionally introduced into AI systems through biased training data, flawed algorithms, or skewed decision-making processes. Addressing bias in AI involves identifying, mitigating, and preventing bias at every stage of the AI development lifecycle, from data collection and preprocessing to model training and deployment.
- **Privacy:** Privacy concerns the protection of individuals' personal data and their right to control how that data is collected, used, and shared. AI systems often rely on vast amounts of data, which may include sensitive information about individuals. It is essential to implement robust privacy measures, such as data anonymisation, encryption, and user consent mechanisms, to ensure that AI solutions respect individuals' privacy rights and comply with relevant data protection regulations.
- **Inclusion:** Inclusion in AI refers to ensuring that AI solutions are accessible, equitable, and beneficial for all members of society, regardless of factors, such as race, gender, disability, or socioeconomic status. This involves considering the diverse needs, perspectives, and experiences of different user groups throughout the design, development, and deployment of AI systems. Inclusive AI design aims to prevent the exacerbation of existing inequalities and to promote equal opportunities and outcomes for all individuals.

By adhering to these AI ethics principles, developers and organisations can contribute to the creation of AI solutions that are not only technically robust but also ethically sound, socially responsible, and aligned with the values and interests of society.

AI Ethical Issues and Concerns

As Artificial Intelligence evolves, so do the issues and concerns around it. Let us review some of the issues and concerns around AI.

Job Loss

With more machines being used for day-to-day work, the fear of unemployment is increasing. With the emergence of AI and automation, there will be technology-driven societal changes. The study reveals, depending upon various adoption scenarios, automation will displace between 400 to 500 million jobs by 2030. There will be shifts in job categories that will impact the economies of many developing countries. AI robots were replaced with human employees in a Japanese Henn-na Hotel. This hotel started with hospitality robot staff in all the departments, but with time the robots could not provide efficient services to its customers and were replaced with human employees after much struggle.

Personal Privacy

In today's scenarios, we are surrounded by technology where an individual's personal life can be tracked easily. The gadgets and the apps used on a daily basis are AI-enabled. The data gathering abilities of AI can access your data from the social networking websites used by you. The cameras installed use facial recognition to identify you in the crowd. You are being followed and recorded everywhere without information. Apple's iPhone X used an advanced front-facing camera and machine learning to create a 3-dimensional map of a face for Face Id recognition. The company claimed that it is programmed to work without errors even for cosmetic changes. But within a few days of its launch, a Vietnam-based security firm-Bkav could unlock the Face ID using 3D-printed masks.

What if AI Makes Mistakes

Yes, it's true, AI can make mistakes. It's recorded that in 2016, when the Uber company conducted a test on self-driving cars in San Francisco, Uber's autonomous vehicle ran six red lights. The situation got out of hand, but a licenced driver was made to sit behind the wheel in case of emergency so he took over control of the situation immediately. In another situation in the same year, Microsoft's chatbot, Tay was released on Twitter. It is based on machine learning, natural language processing and social networks. It learnt its language from the people on Twitter over time that enabled it to have a meaningful conversation based on a topic. But sadly, it was taken offline within 16 hours of its launch as it started tweeting randomly some abusive and offensive content.

Autonomous Weapons

They are also known as killer robots. They can aim independently by pre-programmed instructions. Most of the technically advanced countries are developing these autonomous weapons to safeguard themselves. There are many dangers in using these weapons.

Black Box Problem

This problem is more associated with the neural networking of AI than simple machine learning algorithms. The system uses a huge data bank to learn and produce results. There is no way to understand how the system is working, what exactly the algorithm is doing and what method it is using during the process. Since there is no insight, it is called a Black Box problem. This happens because the data that the AI system is working on, goes through a lot of neural nodes which mutates it, making it extremely difficult to determine the working and the source of the problem.

Ai Task

#Problem Solving & Logical Reasoning

Take your parents' smartphone with their permission and make a list of apps installed on it. Now, surf the Internet and find out the ethical and privacy concerns that are related to these apps. Write YES if any ethical or privacy concern related to the app, otherwise write NO.

Sr. No.	App Name	Ethical or Privacy Concern

AI Bias

Can we trust AI systems? Not yet. AI technology may inherit human biases due to biases in training data. Consider the following examples:

Example 1: Why do most images that show up when you do an image search for "doctor" depict white men?

Example 2: Why do most images that show up when you do an image search for "shirts" depict men's shirts?

Example 3: Why do most search results show "women's salons" when you search for salons nearby?

Example 4: Why do virtual assistants often have female voices?

"AI bias is a phenomenon that occurs when an algorithm produces results that are systematically prejudiced towards certain gender, language, race, wealth, etc., and therefore, produces skewed or learned output. Algorithms can have built-in biases because they are created by individuals who have conscious or unconscious preferences that may go undiscovered until the algorithms are used publicly."

What are the Sources of AI Bias?

Some of the sources of AI bias are:

- **Data:** AI systems are the result of the data that is fed into them. The data used to train the AI system is the first step to check for biasness. The dataset for AI systems should be realistic and need to be of a sufficient size. However, the largest data collected from the real world may also reflect human subjectivity and underlying social biases. The Amazon AI recruitment system is a good example. It was found that their recruitment system was not selecting candidates in a gender-neutral way. The machine learning algorithm was based on the number of resumes submitted over a period of 10 years and most of them were men, so it favoured men over women.
- **Algorithms:** The algorithms themselves do not add bias to an AI model, but they can amplify existing biases. Let's look at an example of an image classifier model trained on images in the public domain—pictures of people's kitchens. It so happens that most of the images are of women rather than men. AI algorithms are designed to maximise accuracy. Therefore, an AI algorithm may decide that the people in the kitchen are women, despite some of the images being of men.

- **Developers:** The last source of AI bias is developers. Those who design AI models focus on achieving the desired goals. On that path at times, the biases of the developers are reflected in their models. It's important to note here that ethics and AI bias are not the problems of the machines but of the humans behind the machines.

AI Access

AI access can be acquired by two means:

- **Data availability:** AI needs access to huge data sets so that it can analyse, draw conclusions, and learn from them.
- **Abilities:** AI needs access to capable hardware to turn its learning into useful action. Self-driven cars are examples of AI with right access.

AI is used on bigger, faster and more expensive machines. AI is a privilege that only a few people can afford and take advantage of this new technology. This has created a gap between these two classes of people and it gets widened with the rapid advancement of technology.

Difference between Ethics and Morals

Ethics and morals are related concepts often used interchangeably, but they have distinct meanings and applications. The word ethics originated from the Greek word ethos. The meaning of ethos is character. The word morals originated from the Latin word mos. The meaning of Mos is custom.

Aspect	Ethics	Morals
Definition	Rules provided by an external source	Principles regarding right and wrong held by an individual
Source	Institutions, organisations, societal norms	Personal beliefs, cultural norms, religious teachings
Application	Specific situations and professional practices	Personal behaviour and conduct
Objective	Maintain order and fairness in society	Foster personal integrity and align with personal values
Examples	Medical ethics, business ethics, legal ethics	Personal beliefs about honesty, integrity, kindness
Origin	External and often codified	Internal and subjective
Scope	Consistent within a profession or society	Varies between individuals
Enforcement	Enforced by external bodies (e.g., professional organisations, legal systems)	Self-governed and enforced by individual conscience
Flexibility	Can change over time to reflect new norms or societal changes	More stable over time, but can evolve with personal growth

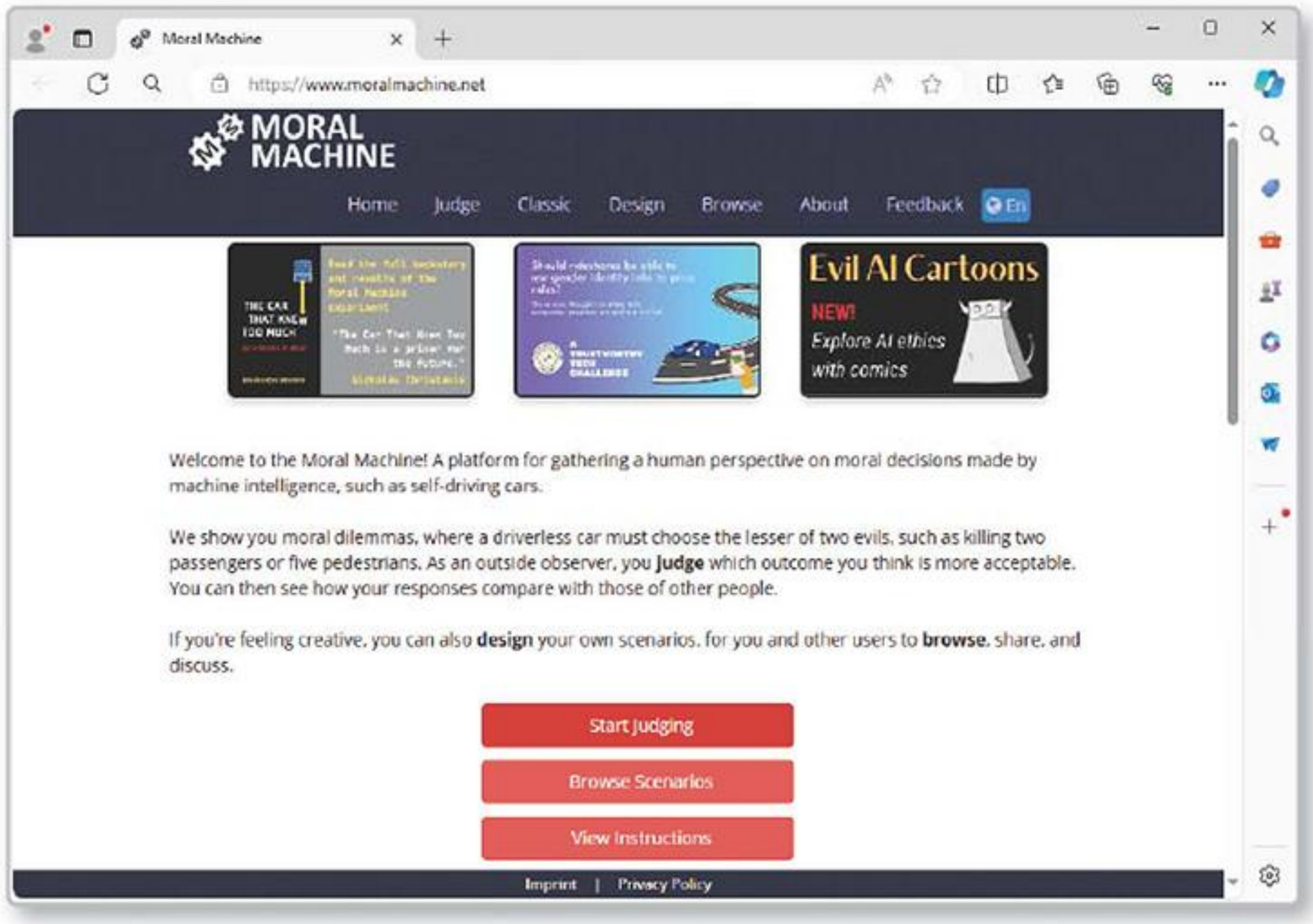
Ai Task

#Ethical & Moral Reasoning

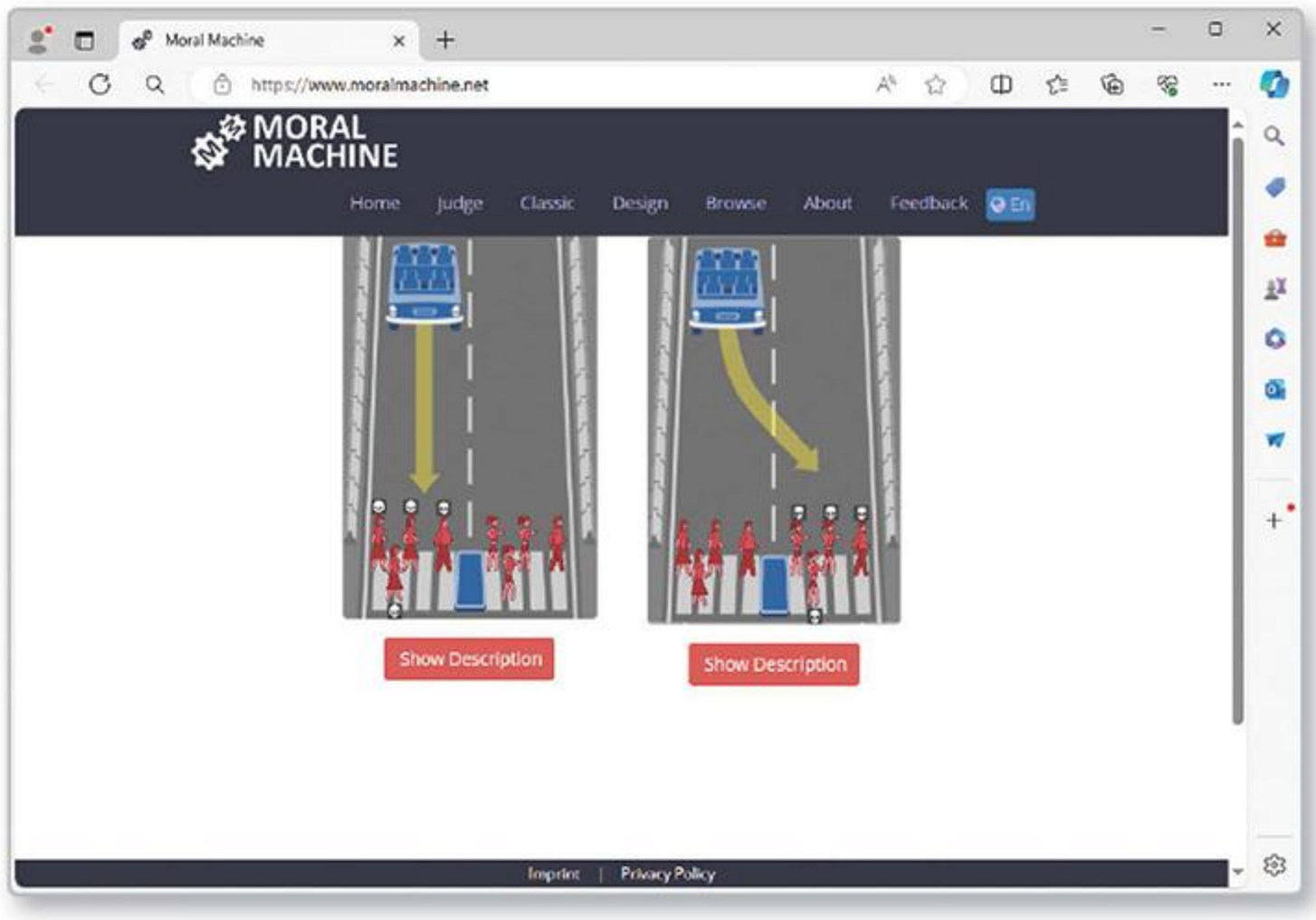
Moralmachine.net is a platform for gathering a human perspective on moral decisions made by machine intelligence such as self-driving cars. It gathers your perspective on a given scenario on how a self-driven car should react/respond, and your results/response can be compared with others in the same situation presented to you. It also allows you to design your own scenarios for you and other users to browse, share and discuss.

Steps to perform the activity:

1. Visit the following link: https://www.moralmachine.net
2. Click on the **Start Judging** button.

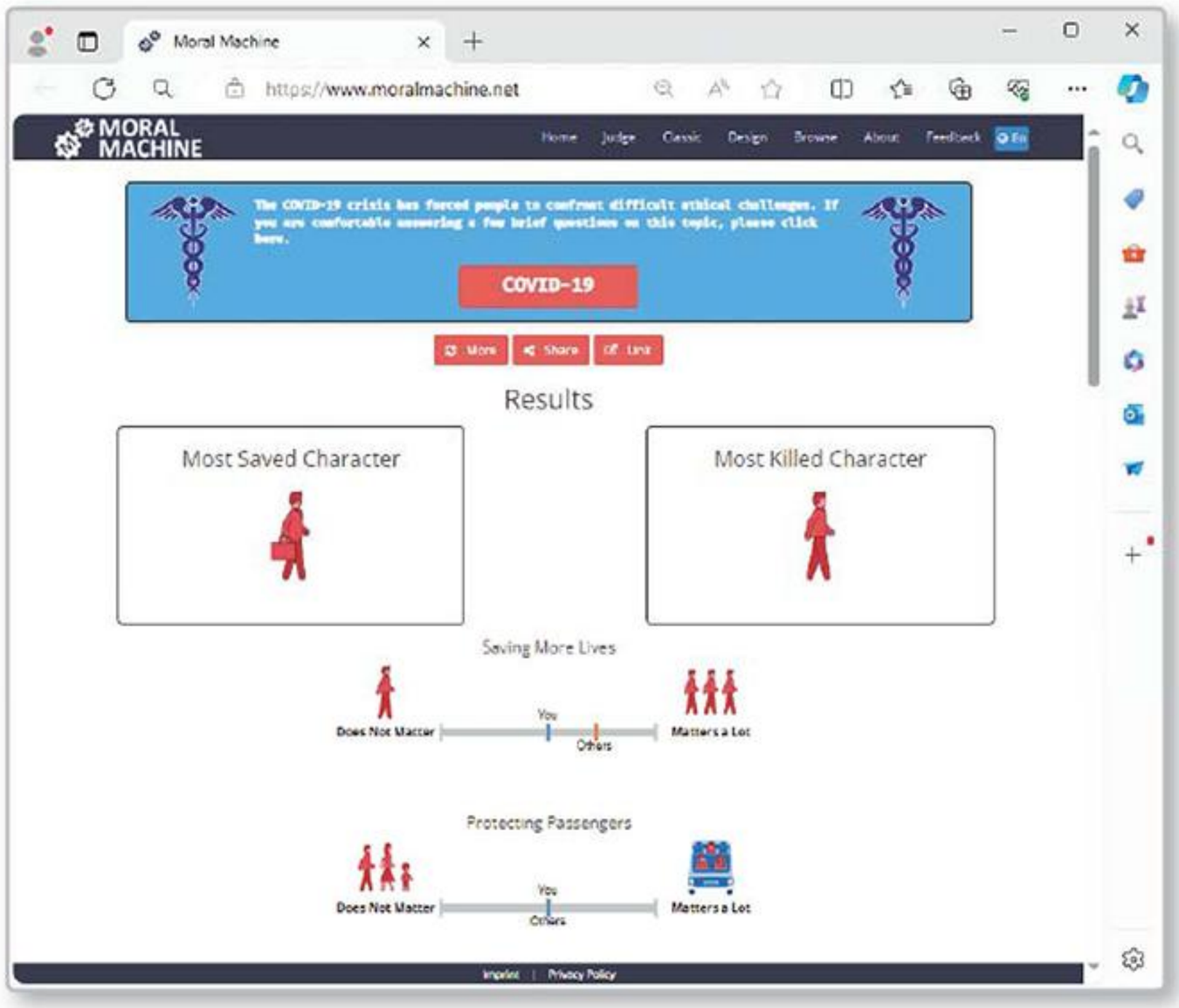


You will see a screen as shown. In this screen, you need to save the characters while crossing the road.



After completing the judging process, a result displays.

3. Answer the questions till the end.



At a Glance

- Artificial Intelligence (AI) is a branch of computer science that simulates human intelligence into machines, especially in computer systems so that they can think and perform actions similar to humans.
- Machines are fed with enough data and correct algorithms to make them intelligent.
- Human-machine interaction (HMI) can be defined as the communication or interaction between humans and machines through a user interface to fulfil a specific task or operation.
- Artificial Intelligence is composed of three domains which are Data, Computer Vision, and Natural Language Processing.
- Data and data statistics are crucial elements in the realm of data analysis, providing the foundation for extracting meaningful insights and making informed decisions.
- Computer Vision (CV) is the domain of Artificial Intelligence that is used to train computers to read, process, and analyse visual data in the same way as humans do.
- NLP gives the ability to machines to read, understand, and analyse meaning from human language.
- Problem scoping is the term used to define the process of selecting a problem that we might want to solve using AI knowledge.
- Stakeholders are individuals or groups who have an interest in the project or are affected by its outcomes.
- Data is a piece of raw information or facts and statistics collected together for reference or analysis.
- Data features refer to the type of data that you want to collect.
- A system map is a diagrammatic representation of a set of things working together. It focuses on the components and boundaries of a system.

- Data exploration means finding the patterns and trends in the data.
- Data visualisation is the graphical representation of data and information.
- Modelling or data modelling is defined as the process of designing decision-making algorithms that have to be trained on a set of data (which was acquired at the data acquisition stage for the problem you scoped in the problem-scoping stage) and applying that learning to recognise certain types of patterns.
- Rule-based data modelling is based on a set of rules and a set of facts already fed to the machine to generate the desired output.
- Learning-based data modelling refers to the model where the relationship or patterns in the data are not defined by the developer.
- Decision trees are tools that follow a rule-based approach that uses a tree-like model of decisions and their possible consequences.
- Evaluation is a process that critically examines a program.
- Confusion matrix is a tabular structure that helps in measuring the performance of an AI model using the test data.
- The ROC curve is a graphical representation that illustrates the performance of a binary classifier system at varying threshold values.
- The deployment phase of the AI project cycle is when the AI model is put into use in a real-world setting.
- AI Project Cycle Mapping Template presents how different stages are related to each other and how the functions performed in every phase form an input for the next phase.
- Ethics are rules about what is right and wrong. AI ethics are rules about using artificial intelligence (AI) in a good way.
- AI bias is a phenomenon that occurs when an algorithm produces results that are systematically prejudiced towards certain gender, language, race, wealth, etc., and therefore, produces skewed or learned output.

Exercise

Solved Questions

SECTION A (Objective Type Questions)

AI Quiz

A. Tick (✓) the correct option.

1. Which of the following is the ability of intelligence?
   a. To learn ○ b. To think ○
   c. To solve problems ○ d. All of these ○
2. Which of the following refers to the simulation of human intelligence processes by machines?
   a. Intelligence ○ b. Machine ○
   c. Artificial Intelligence ○ d. Processing the data ○
3. Who is the father of Artificial Intelligence?
   a. John McCarthy ○ b. Mark Zuckerberg ○
   c. Alan Turing ○ d. Nick Bostrom ○

4. Which of the following is the National AI portal of India?
   a. PortalIndia ○ b. AiIndia ○
   c. INDIAai ○ d. IndiaIT ○
5. Which of the following is not a domain of AI?
   a. Data Statistics ○ b. Computer Vision ○
   c. Natural Language Processing ○ d. Information ○
6. Which type of data can be used as input in the Computer Vision domain of AI?
   a. Numeric ○ b. Symbols ○
   c. Image and Video ○ d. All of these ○
7. Which of the following is an application in which the NLP domain is used?
   a. Google Assistant ○ b. Alexa ○
   c. Siri ○ d. All of these ○
8. Which of the following is not a type of AI?
   a. Artificial Narrow Intelligence ○ b. Artificial General Intelligence ○
   c. Artificial Super Intelligence ○ d. Artificial Fastest Intelligence ○
9. Which of the following is a diagrammatic representation of a set of things working together?
   a. Data visualisation ○ b. AI mapping template ○
   c. System map ○ d. Nomura ○
10. ..... has successfully developed a system that can analyse retinal scans and spot symptoms of sight-threatening eye diseases.
   a. Google's DeepMind ○ b. Chatbots ○
   c. See & Spray ○ d. Data graph ○
11. A self-driving car identifies objects in front of it using ..... domain of AI.
   a. Computer Vision ○ b. Data Science ○
   c. NLP ○ d. Data Mining ○
12. The See & Spray robot is used in which of the following field?
   a. Agriculture ○ b. Business ○
   c. Education ○ d. Healthcare ○
13. The ..... is a graphical representation that illustrates the performance of a binary classifier system at varying threshold values.
   a. ROC curve ○ b. Confusion matrix ○
   c. Data augmentation ○ d. Data matrix ○
14. ..... means finding the patterns and trends in the data.
   a. Data visualisation ○ b. Data exploration ○
   c. Data augmentation ○ d. Data validation ○

B. Fill in the blanks.

1. ..... feature of smartphone makes the background blur while focusing the foreground object.
2. ..... will be able to understand humans and will be able to evoke their own emotions and desires.

3. Google launched its Waymo division to design, manufacture and market ..... .
4. We feed machines with ..... for analysis.
5. They are four-legged robots designed by ..... dynamics for commercial applications.
6. ..... and ..... developed the Logic Theorist, the first artificial intelligence program.
7. Domain in which images and videos are provided as input is .....
8. ..... says "AI is a fundamental risk to the existence of human civilisation."
9. A ..... refers to a central topic or recurring issue that emerges from the analysis and exploration of a particular problem space.
10. Navigation apps use AI for suggesting ..... and live traffic updates.
11. The ..... mobile app is used in agriculture.
12. ..... can be used to answer FAQs for smooth business functioning.
13. Blue River Technology developed a robot called ..... .
14. ..... helps us to find relationships between different elements of the problem which we have scoped.
15. ..... tools are established to track the model's performance and ensure it works correctly.

C. State whether these statements are true or false.

1. Waymo is a division of IBM for launching driverless cars. .....
2. In India, the first Community Centre for Artificial Intelligence was launched in Hyderabad. .....
3. The main focus of AI would be to replace humans in hazardous jobs. .....
4. Many big companies of the world like Google, Microsoft, IBM, etc. set up their research centres and AI labs in India. .....
5. Apple's Siri is a digital virtual assistant that operates with a predefined limited range of operations. .....
6. AI has the capacity to carry out complex tasks. .....
7. A humanoid robot was created by Honda in 2020. .....
8. AI has 6 domains. .....
9. Data can also be collected from various sensors. .....
10. Data visualisation encompasses few aspects of the visual representation. .....
11. Evaluation ensures that the model is operating correctly and optimally. .....
12. An AI code of ethics is a set of rules that says how AI should be used to help people. .....
13. X (formerly known as Twitter) uses AI to keep a check on inappropriate and objectionable content. .....
14. AI provides less help in banking and finance. .....
15. Tesla's, self-driving cars, uses negligible AI. .....

D. Match the following:

1. Audio or Video	a. Question-answering machine
2. Super AI	b. Humanoid robot
3. IBM Watson	c. NLP
4. Sophia	d. Japanese brokerage house
5. Semantris	e. Surpass human intelligence
6. Nomura	f. Computer vision

SECTION B (Subjective Type Questions)

A. Short answer type questions:

1. What is INDIAai?

Ans. INDIAai is the National AI Portal of India. It is a central hub for everything related to AI in India. It is a joint initiative of MeitY, NeGD and NASSCOM.

2. What is the reason for big companies establishing their AI labs in India?

Ans. The favourable ecosystem, economy and the vast pool of talent in India have brought many big companies of the world like Google, Microsoft, IBM, etc. to set up their research centres and AI labs in India.

3. Name three different Domains of AI?

Ans. The three different Domains of AI are:

- Data Statistics
- Natural Language Processing
- Computer Vision

4. What is Natural Language Processing?

Ans. NLP is the ability of machines to read, understand and analyse meaning from human language.

5. What is the concept of computer vision?

Ans. Computer vision is used to train computers to read, process and analyse visual data in the same way as humans do.

6. Define the term confusion matrix.

Ans. Confusion matrix is a tabular structure that helps in measuring the performance of an AI model using the test data.

7. How does AI help in the agriculture field?

Ans. AI can help farmers to get more from the land, and use resources more sustainably. Blue River Technology developed a robot called See & Spray, which uses computer vision and image recognition software to monitor and precisely spray pesticide on cotton plants. Plantix mobile app uses AI-powered image recognition software to help farmers to detect plant diseases.

8. What do you understand by the evaluation stage of the AI project cycle?

Ans. Evaluation is a process that critically examines a program. It involves collecting and analysing information about a program's activities, characteristics, and outcomes. Its purpose is to make judgments about a program, to improve its effectiveness, and/or to inform programming decisions.

9. What is the black box problem?

Ans. The system uses a huge data bank to learn and produce results. There is no way to understand how the system is working, what exactly the algorithm is doing, and what method it is using during the process. Since there is no insight, it is called a black box problem. This happens because the data that the AI system is working on, goes through a lot of neural nodes which mutates it, making it extremely difficult to determine the working and the source of the problem.

10. List the categories in which the AI systems are classified.

Ans. AI can be classified into three categories:

- Weak AI
- Strong AI
- Super AI

11. Why is data considered an important source of AI bias?

Ans. The dataset for AI systems should be realistic and need to be of a sufficient size. However, the largest data collected from the real world may also reflect human subjectivity and underlying social biases.

12. What is an ethical concern of AI?

Ans. AI is a powerful tool. It can be used in ways that can affect the society—positively or negatively. Like electricity or nuclear energy, a lot depends on us—how we utilise AI for humanity.

B. Long answer type questions:

1. Explain any three world famous AI machines.

Ans. The three AI machines are:

- **IBM Watson:** It is a question-answering machine that combines artificial intelligence (AI) and sophisticated analytical software. It answers the questions posed in natural languages. Companies use it for analysing the data, predicting future growth prospects and automating some tedious and complex processes.
- **Google's Driverless car:** Google launched its Waymo division to design, manufacture and market driverless vehicles around the world. These cars are AI-enabled.
- **Sophia, the Humanoid Robot:** It was designed by Hong Kong-based company Hanson Robotics in Feb 2016 and made her first public appearance in March 2016 in the USA.

2. List down the advantages of AI.

Ans. The following are the advantages of AI:

- **Increased automation:** AI can be used to automate anything, ranging from tedious tasks to the process of recruitment of employees. There are AI-based applications that can be used for the hiring of new recruits. Mya, is an AI app that automates tedious parts of the recruitment process such as sourcing, screening, and scheduling.
- **Increased productivity:** AI is widely used in businesses. It is used to manage highly computational tasks that require maximum effort and time. Starting from staff recruitment to automated packing of products, AI has the potential to increase productivity.
- **Smart decision-making:** AI helps in making smart decisions. Salesforce Einstein Analytics is a comprehensive AI for CRM (Customer Relationship Management), designed to enable companies to make smarter business decisions. The goal of this technology is to give sales and marketing departments more comprehensive customer behaviour and sales prospects.
- **Solve complex problems:** AI is being used to solve complex problems that cannot be solved by human beings. Through the years, AI has progressed from simple machine learning algorithms to advanced machine learning concepts that have helped resolve complex problems like fraud detection, medical diagnosis, weather forecasting, and so on.
- **Strengthens economy:** AI is estimated to contribute $15 trillion to the world's economy by 2030. It is estimated that the greatest impact of AI will be in the fields of healthcare and robotics. The rise in the economy will mainly be from the substitution of work by automation and increased innovation in products and services.

3. Give three examples of AI around us.

Ans. The three examples of AI around us are as follows:

- **Smartphones:** The built-in smart assistants (like Siri) are some obvious examples of AI. Google's AI-powered predictions have a visible impact in every person's life. The portrait mode of the camera on our smartphone is also an AI feature. It makes the background blur while focusing on the foreground object.
- **Email spam filters:** Email categorisation and spam filters are some of the powerful features of AI that affect our inbox. Simple rule-based filters are used to mark spam or put email into various categories as Primary, Social, Promotion or Important.
- **Virtual assistants:** Smart virtual assistants that we use to control our smart house are prime examples of AI impacting our daily lives. They use AI to study our behaviour and patterns so, that they can adjust themselves automatically. They are capable to do several things like sending quick messages, setting reminders, checking the weather and getting the latest news.

4. How can a machine become intelligent?

Ans. Artificial Intelligence makes the machines intelligent. Programming along with some aspects of human intelligence like decision-making and problem-solving gives rise to intelligent machines. Machines are fed with enough data and correct algorithms to make them intelligent.

5. "The more the data, the better will be the analysis" Justify.

Ans. AI requires large amounts of data to find the latest trends and patterns. For example, I plan to organise a social gathering in an open air setup in the month of August in Delhi. I will have to look for a weather forecast for the same and also look at the previous years' trends. So data collection is the base for analyses and pattern recognition models. From those patterns, predictive models can be made. Applications of AI in data sciences can be seen in weather forecasting, score prediction, targeted advertisement, predictive analysis in finance.

6. Explain the ethical issue related to problem selection.

Ans. When identifying an issue for an AI project, consider how it will influence individuals as well as society. These are some important ethical issues:

- **Fairness:** Make sure that the AI system does not unfairly favour a particular group above others.
- **Privacy:** Ensure that the AI system protects the confidentiality of individuals and never collects or uses the private data of individuals without their consent.
- **Transparency:** People should know how exactly the AI system functions as well as why specific choices are made.
- **Social impact:** Examine how the AI system may influence society as a whole, and how it might encourage biases or cause of social divisions.
- **Environmental impact:** Examine how AI systems could have negative impacts on the environment. For example, consuming a lot of electricity or emitting pollutants.

7. What is Data? Also, explain the types of data.

Ans. Data is a piece of raw information or facts and statistics collected together for reference or analysis. They are raw facts that need to be processed to get meaningful information. Whenever we want the AI project to be able to predict an output, we need to train it with a data set first. Data plays an important part of an AI project as it creates the base on which the AI project is built.

There are two types of data:

- **Training data:** It is data on which we train our AI project model. It is basically to fit the parameters of the project for the model. In training data, the output is available to the model.
- **Testing data:** It is used to check the performance of an AI model. In testing data, the data is not seen for which the predictions have to be made.

8. What is the need for visualising data?

Ans. The needs for data visualisation are:

- It simplifies the complex quantitative information.
- It analyses and explores big data easily.
- It identifies the areas for improvement.
- It identifies the relationship between data points and variables.
- It explores new patterns and reveals hidden patterns.

9. What is the application of AI in healthcare?

Ans. For saving human lives, the medical industry is relying on AI on many fronts. Healthcare organisations are using IBM Watson for medical diagnosis. Google's DeepMind has successfully developed a system that can analyse retinal scans and spot symptoms of sight-threatening eye diseases. AI is used in diagnostic centres to analyse samples of tissues and provide accurate results.

10. What are issues and concerns related to AI?

Ans. Following are the concerns related to AI:

- **Job Loss:** With more machines being used for day-to-day work, the fear of unemployment is increasing.
- **Personal Privacy:** The cameras installed use facial recognition to identify you in the crowd. You are being followed and recorded everywhere without information.
- **AI can make mistakes:** Microsoft's chatbot-Tay and Uber using self-driven cars are some of the famous mistakes made by AI.

C. Competency-based/Application-based questions:

#Experiential Learning

1. If a person develops an AI algorithm, would his/her bias be reflected in the AI algorithm? For example, if an American developer develops an AI algorithm that is trained for his accent only, is it not a bias for people with different accents?

Ans. Yes, the biases of the developer of the AI algorithm can be reflected in the AI algorithm. For example, if an American developer creates an AI algorithm trained primarily on American accents, it may perform poorly for people with different accents. This is a bias in the algorithm as it fails to equally accommodate all users. A practical example of bias in AI can be seen in search results; when searching for "Places to buy white formal shirts," the algorithm might predominantly show brands like Raymonds and Peter England that specialise in men's collections, potentially overlooking brands that cater to women or unisex options.

2. If you've ever used Amazon's Alexa, Apple's Face ID, or interacted with a chatbot, you have interacted with artificial intelligence technology. AI technology hasn't been around from that long. It's only in the past decade that artificial intelligence evolved into technology like facial recognition and autonomous cars. Answer the following questions:

   a. What are chatbots?

   b. Name the domain of AI that Alexa belongs to.

   c. Name the domain of AI that Facial recognition belongs to.

   d. Mention one disadvantage of using AI.

Ans. a. A chatbot is a computer program that simulates human conversation through voice commands, text chats, or both.

b. Natural Language Processing

c. Computer Vision

d. One disadvantage of using AI is the potential for privacy invasion.

Assertion and Reasoning Questions:

Direction: Questions 3-4, consist of two statements – Assertion (A) and Reasoning (R). Answer these questions by selecting the appropriate option given below:

a. Both A and R are true and R is the correct explanation of A.

b. Both A and R are true but R is not the correct explanation of A.

c. A is true but R is false.

d. A is false but R is true.

3. **Assertion (A):** System maps tool helps figure out the relationship of elements with the project's goal.
   Reasoning (R): Positive arrows determine a direct relationship of elements while the negative arrows show an inverse relationship of elements.

Ans. a.

4. **Assertion (A):** A self-driving car is made up of a combination of sensors, cameras, radar and AI.

   Reasoning (R): The owner is liable if a self-driving car is involved in an accident.

Ans. c.

Statement Based Question:

Two statements are given. Statement 1 and Statement 2. Examine the statements and answer the question according to the instructions given below.

a. Statement 1 is True, Statement 2 is True

b. Statement 1 is False, Statement 2 is False

c. Statement 1 is True, Statement 2 is False

d. Statement 1 is False, Statement 2 is True

5. **Statement1:** AI is getting integrated into our lives seamlessly.

   Statement2: Often we do not even realise that we are using AI.

Ans. a.

Unsolved Questions

SECTION A (Objective Type Questions)

AI Quiz

A. Tick (✓) the correct option.

1. Autonomous Weapons are also known as ..... .

   a. Killer Robots ○ b. Automatic Robots ○

   c. Micro Robot ○ d. All of these ○

2. A web-based software that is used to create interactive stories in Choose Your Own Adventure Format (CYOA) is [CBSE Sample Paper 2022]

   a. Chatbot ○ b. Jupyter notebook ○

   c. Internet explorer ○ d. Inklewriter ○

3. Which of the following is not an advantage of AI?

   a. Increased automation ○ b. Increased productivity ○

   c. Smart decision-making ○ d. Expensive technology ○

4. An application lets you search what you see, get things done faster and understand the world around you, using just your camera or a photo. Which domain does this app belong to?

   a. Natural Language Processing ○ b. Data Sciences ○

   c. Computer Vision ○ d. Artificial Language Processing ○

5. The decision tree starts from the ..... .

   a. Root node ○ b. Branch ○

   c. Leaf node ○ d. Question node ○

6. IoT is abbreviated as [CBSE Sample Paper 2022]

   a. Institute of Technology ○ b. Internet of Things ○

   c. Index organised Table ○ d. Inter-operability Test ○

7. Statement1: The drone technology help farmers spot intrusions, crop diseases, predict the amount of crop production, and saves time and avoids the difficulties of physical manual inspections. [CBSE Sample Paper 2022]

   Statement2: The statement given above is an example of Natural Language Processing.

   a. Both Statement1 and Statement2 are correct.
   b. Both Statement1 and Statement2 are incorrect.
   c. Statement 2 is correct and Statement 1 is incorrect.
   d. Statement 1 is correct and Statement 2 is incorrect.

8. Diabetic Retinopathy (DR) is a severe complication of diabetes that affects the blood vessels in the .....

   a. Wrist
   b. Retina
   c. Face
   d. Lungs

9. In ....., the target variable has two values: Positive and Negative.

   a. ROC curve
   b. Evaluation graph
   c. Confusion matrix
   d. Prediction

10. Statement1: AI is getting integrated into our lives seamlessly. [CBSE Sample Paper 2022]

    Statement2: Often we do not even realise that we are using AI.

    a. Statement 2 is correct and Statement 1 is incorrect.
    b. Statement 1 is correct and Statement 2 is incorrect.
    c. Both Statement1 and Statement2 are correct.
    d. Both Statement1 and Statement2 are incorrect.

11 Which one of the following is an application of AI? [CBSE Handbook]

   a. Remote controlled Drone
   b. Self-Driving Car
   c. Self-Service Kiosk
   d. Self-Watering Plant System

12. Match column A with Column B [CBSE Sample Paper 2022]

Column A		Column B	
1.	Expert System	A.	Simulate how a human would behave as a conversational partner.
2.	Chatbot	B.	Uses knowledge stored in a knowledge base but requires the intervention of human expert.
3.	Digital Assistant	C.	Autonomous vehicle
4.	Self-driving Car	D.	Works on various mobile platforms

   a. 1 -> B; 2 -> A; 3 -> D; 4 -> C
   b. 1 -> A; 2 -> B; 3 -> C; 4 -> D
   c. 1 -> D; 2 -> A; 3 -> B; 4 -> C
   d. 1 -> C; 2 -> A; 3 -> D; 4 -> B

13. Fill in the blanks with the correct answers given below: [CBSE Sample Paper 2022]

    The ..... Sustainable Development Goals (SDGs) were launched at the United Nations Sustainable Development Summit in New York in the year ....., forming the ..... Agenda for Sustainable Development.

    a. 17 , 2015 , 2030
    b. 15 , 2010 , 2025
    c. 17, 2010 , 2025
    d. 15 , 2010 , 2030

B. Fill in the blanks.

1. AI helps you to solve long and complex calculations faster with ..... .
2. ..... and ..... has attracted many international companies to set up AI labs in India.
3. Sophia is designed by Hong Kong based company, ..., in Feb 2016.
4. We can use data for ..... and ..... .
5. Computer vision is used for ..... .
6. The ..... collects data from digital images and videos, and then processes the data to identify the objects in the image/video.
7. ..... is a word association game based on NLP.
8. The ..... process is an important approach to problem scoping that helps in continually improving a design or product using an AI model.
9. ..... are a set of functions and procedures that allow one application to connect to another.
10. AI systems are the result of the ..... that is fed into them.

C. State whether these statements are true or false.

1. Mimicking the human voice, speak on your behalf is not possible through AI. .....
2. Deep learning follows a specific learning approach which is a subset of machine learning comprising multiple machine learning algorithms. .....
3. AI cannot be used to detect depression in a child's speech. .....
4. Narrow AI performs dedicated tasks with intelligence. .....
5. AI is used to control the creation of characters, animals or machines in games. .....
6. Machine learning means equipping machines with the power to think and make decisions just like human beings. .....
7. Mya is a comprehensive AI for CRM (Customer Relationship Management), designed to enable companies to make smarter business decisions. .....
8. AI refers to any technique that enables computers to mimic or imitate, develop, and demonstrate human intelligence. .....
9. Quick Draw is a platform for gathering a human perspective on moral decisions made by machine intelligence such as self-driving cars. .....
10. Inclusion in AI refers to ensuring that AI solutions are accessible, equitable, and beneficial for all members of society, regardless of factors such as race, gender, disability, or socioeconomic status. .....

SECTION B (Subjective Type Questions)

A. Short answer type questions:

1. Give an application of computer vision in AI.
2. Name any three important areas where AI has made a remarkable impact.
3. Explain in short how AI can be the future of mankind.
4. Explain the concept of data statistics as a domain of AI.
5. What is the main goal of creating a confusion matrix?
6. What is a leaf node in decision tree?
7. Explain in short the concept of data acquisition.
8. What are the difference between weak AI and narrow AI?
9. Explain the AI research in natural language understanding.

10. How can AI be helpful in space exploration?
11. How can AI lead to unemployment?
12. AI proves to be a boon for repetitive tasks. Explain.

B. Long answer type questions:

1. How is artificial general intelligence different from artificial super intelligence?
2. Explain any three important careers in AI.
3. What are the disadvantages of AI?
4. Why is computer vision an important domain of AI?
5. Give any three important applications of AI in real life.
6. How is AI of great help in email communication?
7. List down the three most important jobs at risk due to AI.
8. Explain any two sources of AI bias.
9. What are the principles of AI ethics?
10. List down the difference between ethics and morals.

C. Competency-based/Application-based questions:

#Problem Solving & Logical Reasoning

1. Aparna went to drop her daughter to Medical college in Bangalore. She uses Google Maps to travel from one place to another. Soon she realised that she started getting recommendations of famous tourist places in and around Bangalore on her social media account. That means this platform is using recommendations based on _____.
2. Information about three games are given below. Identify the game and the respective domain. [CBSE Sample Paper 2022]
   i. The players of this game have to guess what the opponents will choose and make an appropriate shape to defeat them.
   ii. This is a simple twenty questions game in which the player can ask 20 Yes/No questions to identify the animal.
   iii. In this game, the computer asks the player to find objects that match certain images within a time limit.
      a. i. Emoji Scavenger Hunt -> Computer vision; ii. Rock, Paper, Scissor -> Natural Language Processing; iii. Mystery Animal -> Data Sciences
      b. i. Mystery Animal -> Data Sciences; ii. Emoji Scavenger Hunt -> Natural Language Processing; iii. Rock,Paper,Scissor -> Computer vision
      c. i. Rock, Paper, Scissor -> Data Sciences; ii. Emoji Scavenger Hunt -> Natural Language Processing; iii. Mystery Animal -> Computer vision
      d. i. Rock, Paper, Scissor -> Data Sciences; ii. Mystery Animal -> Natural Language Processing; iii. Emoji Scavenger Hunt -> Computer vision
3. Choose the AI applications among the ones given below: [CBSE Sample Paper 2022]
   i) Gmail uses Smart Compose feature can help you type emails faster as it offers suggestions for words and phrases as you type.
   ii) Websites make use of a software that simulates human-like conversations with users via text messages on chat.
   iii) Soap dispensers use infrared sensors with which when hands are placed in the proximity of the sensor, dispense the designated amount of soap.
   iv) Face recognition technology that identifies and verifies a person using the person's facial features and automatically marks attendance.

   a. i), ii) and iv)
   b. i), ii) and iii)
   c. ii), iii) and iv)
   d. i), iii) and iv)

Assertion and Reasoning Questions:

Direction: Questions 4-5, consist of two statements – Assertion (A) and Reasoning (R). Answer these questions by selecting the appropriate option given below:

a. Both A and R are true and R is the correct explanation of A.

b. Both A and R are true but R is not the correct explanation of A.

c. A is true but R is false.

d. A is false but R is true.

4. **Assertion (A):** Talking to an NLP-enabled machine is like conversing with a person.

   Reasoning (R): NLP employs algorithms to analyse and interpret natural language data such as speech and text.

5. **Assertion (A):** A pie chart is divided into segments to represent values of different sizes.

   Reasoning (R): Pie chart is very effective when we have so many data series.

Ai In Life

#Creativity & Innovativeness
#Interdisciplinary

1. Create a poster displaying how AI helps the farmers to achieve maximum yield from the available resources. While creating the poster, include facts like how much yield was achieved before using AI technology and how much growth was evident due to AI.
2. The demand of AI products is increasing rapidly. People are interested in AI-based products, but on the flip-side we can see that AI devices are connected to a network and can communicate with other devices or users. This means that the control of data is not in our hands. So, do you think this is safe for the user? Is it alright to let other people or programs control our information? Write an article in 150 words and share with your class.

Ai Deep Thinking

#Interdisciplinary

1. AI is an extremely powerful technology. It has all the economic data and military data at its fingertips and it can also learn as it works in the real world. Do you think AI can turn evil one day and attack the very humans who created it? What could be the possible factors that turn an AI evil? Discuss with your teacher and the class.
2. Write a letter to your future self, assuming we are in 2030. Be sure to mention things that you think your future self would probably be doing. It should mention how there has been change over all these years in terms of technology.

   Place _____

   Date _____

   Dear Future Self,

   _____

   Hope this letter brings back old memories.

   Sincerely,

   _____

3. One of the major parts of a person's career is a job. AI has been replacing people in the employment sector. Try to find out how people change their career path once AI takes over their role. Based on your findings, write a speech in 200 words on how this is good or bad and what can be done to improve the situation.

Ai Lab

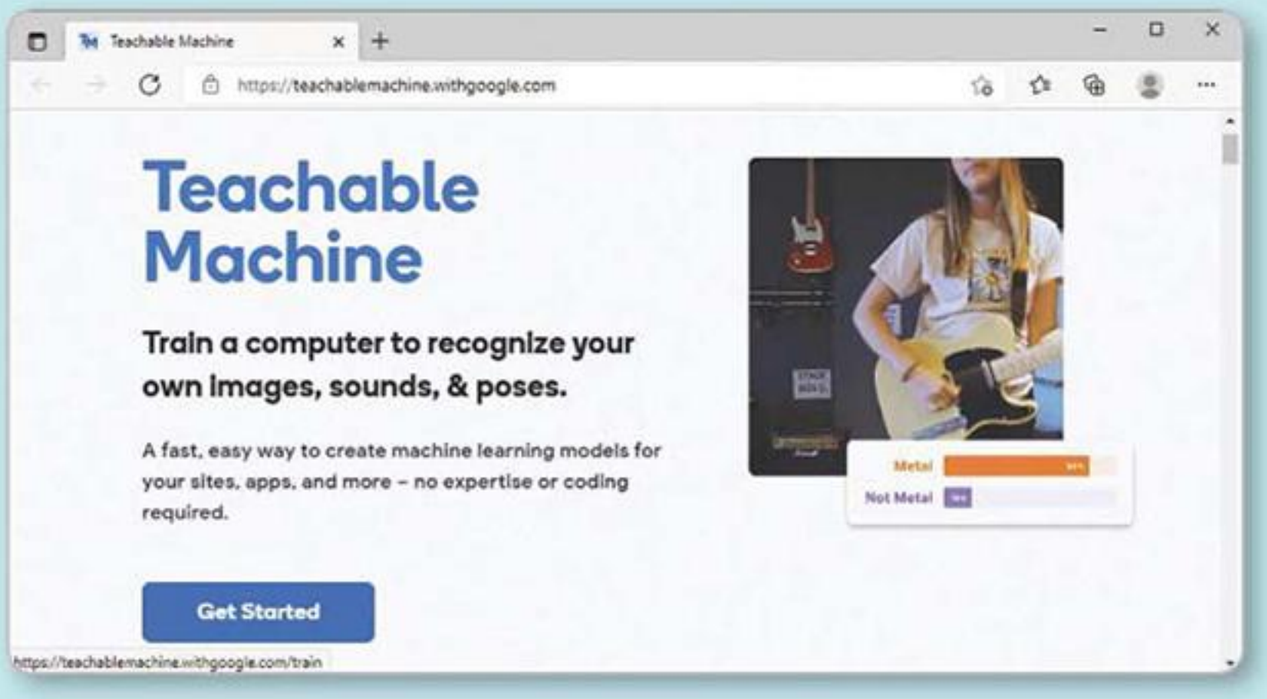
#Experiential Learning

1. Create a PowerPoint presentation on the topic "Popular AI Machines." Insert suitable pictures of AI machines. You can also add videos on the slides to make them more interesting.
2. Suppose, you are working as an engineer in a robot manufacturing company where you have to make the design of a robot. Draw the same design of the robot in Paint that you would like to create in the company. Write any 5 features that you would like to have in your robot.
3. **Techable Machine Experiment:** This experiment is based on the Computer Vision domain of AI. The main aim of this experiment is to teach an AI machine to recognise your actions. Once the AI machine is trained, it works according to your actions.

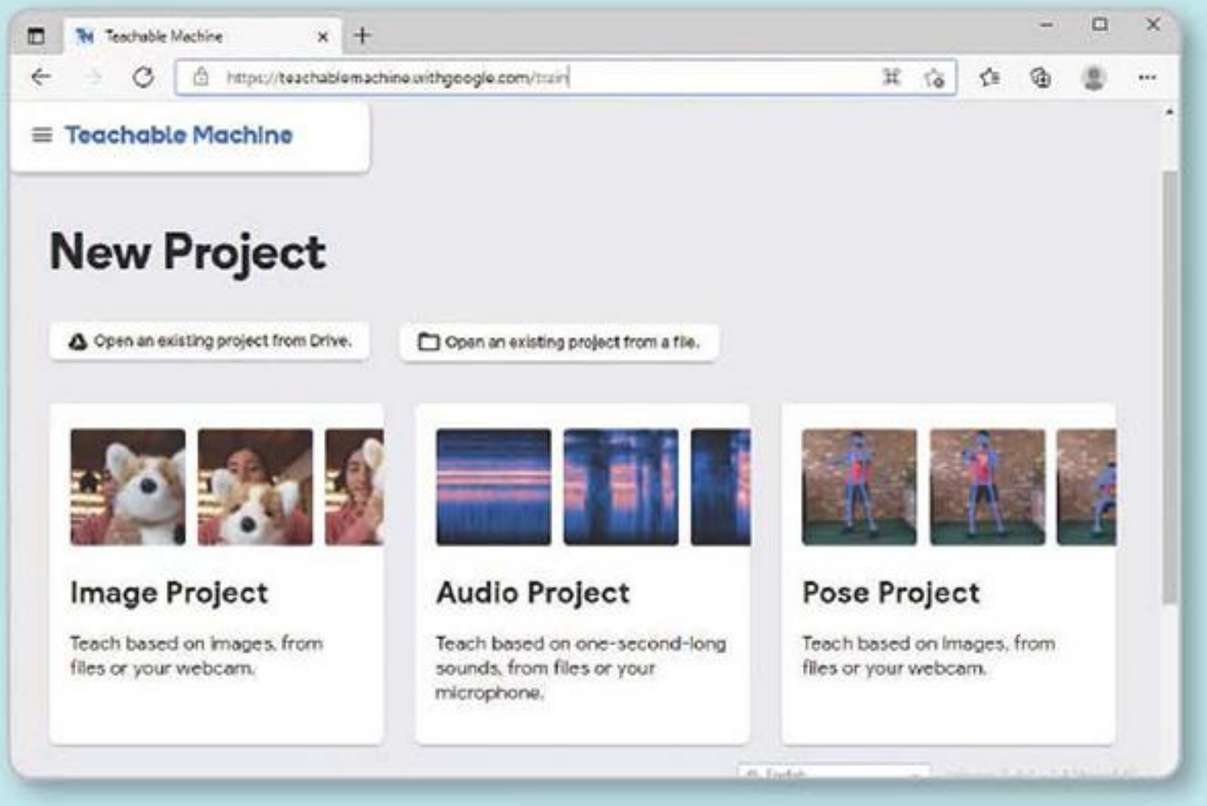
Open the following link to use this experiment:

https://teachablemachine.withgoogle.com/

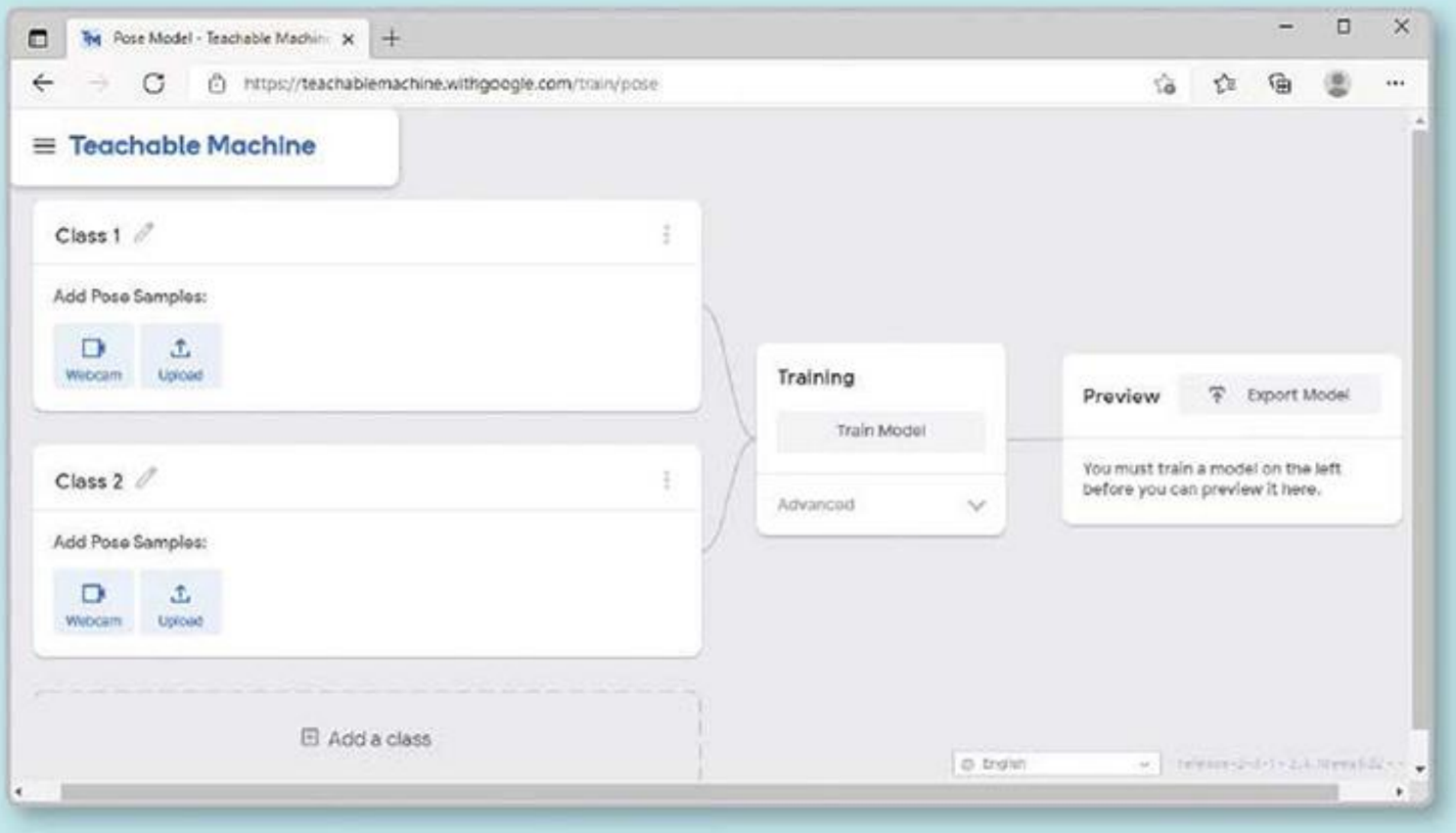
Click on Get Started button.



Before clicking on the Get Started button, ensure that the microphone and camera of your laptop(recommended)/desktop computer should be working properly. When you click on the Get Started button, the following screen will appear:



This screen contains three options to train the AI machine. Click on any one of the three options according to your requirement. In this case, we have clicked on the Pose Project option. The following screen will appear:



Here, you can take a pose from webcam or upload an existing pose. You need to take at least 30 poses to get a better response from the machine.

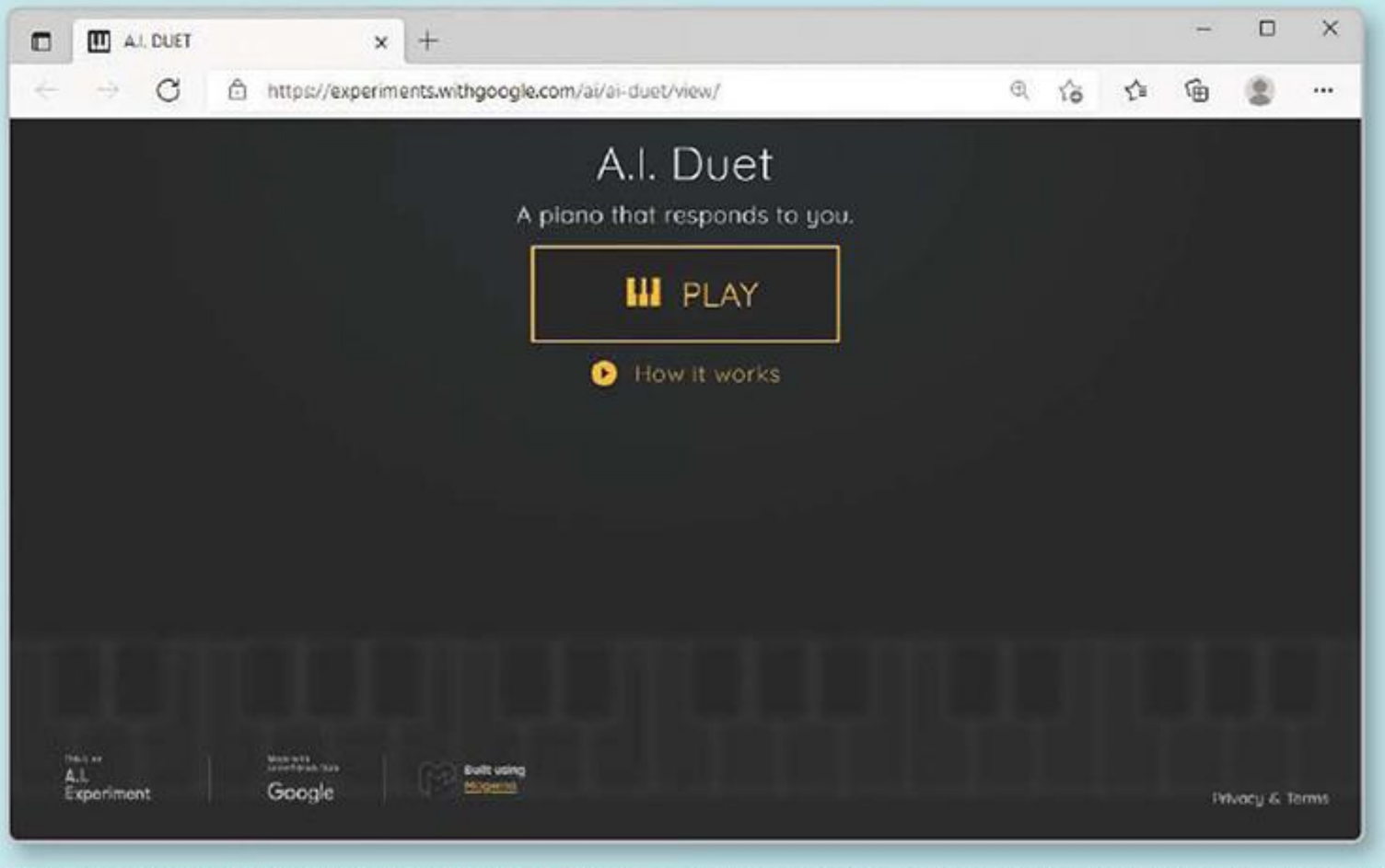
4. **AI Duet:** This experiment is based on the data domain of AI. It allows you to play piano with the computer. You can play this game even if you do not have any prior knowledge of how to play piano.

   When you press the key, it becomes blue.

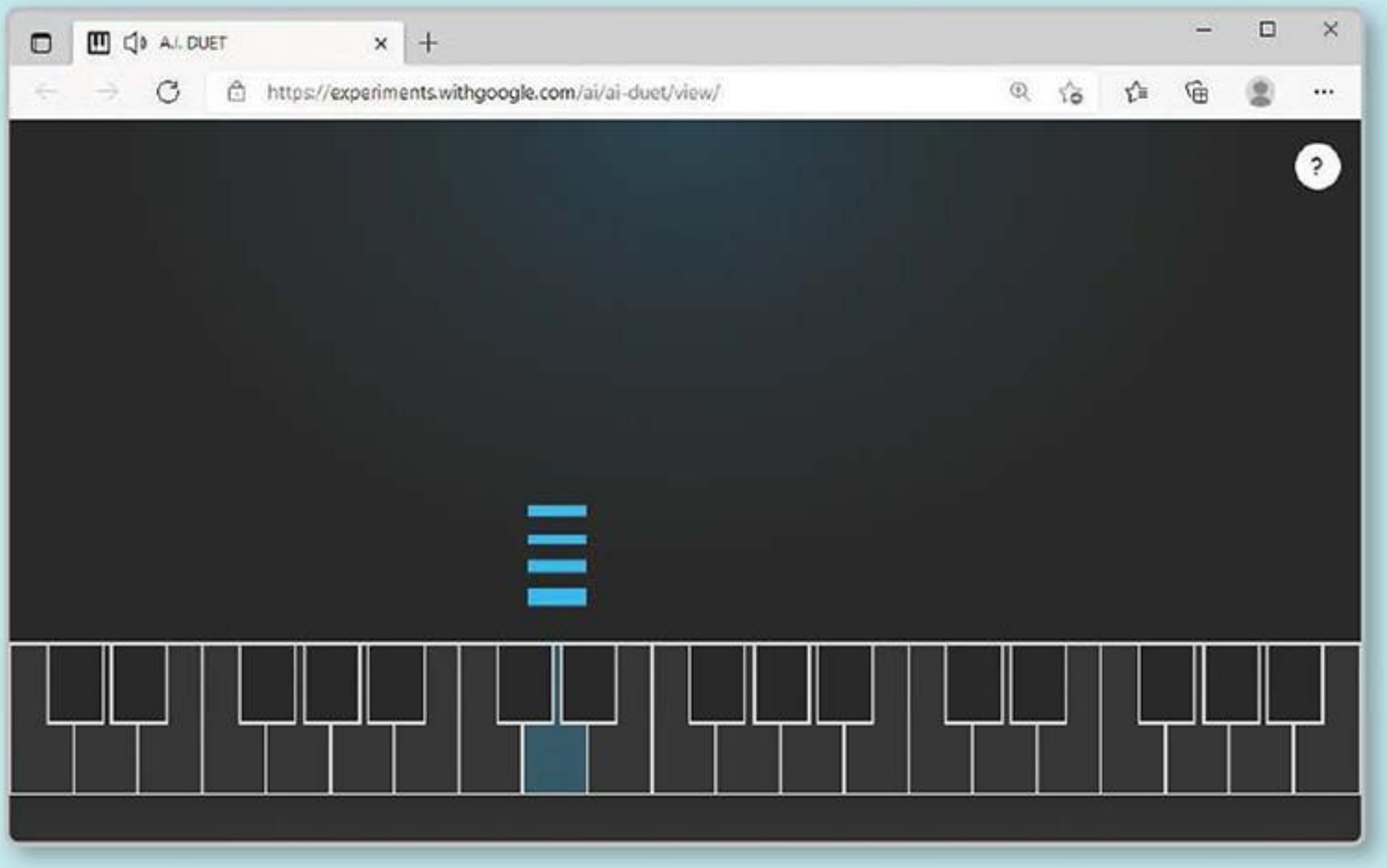
   To play the game, visit the following link on any computing device with speakers:

   https://experiments.withgoogle.com/ai/ai-duet/view/

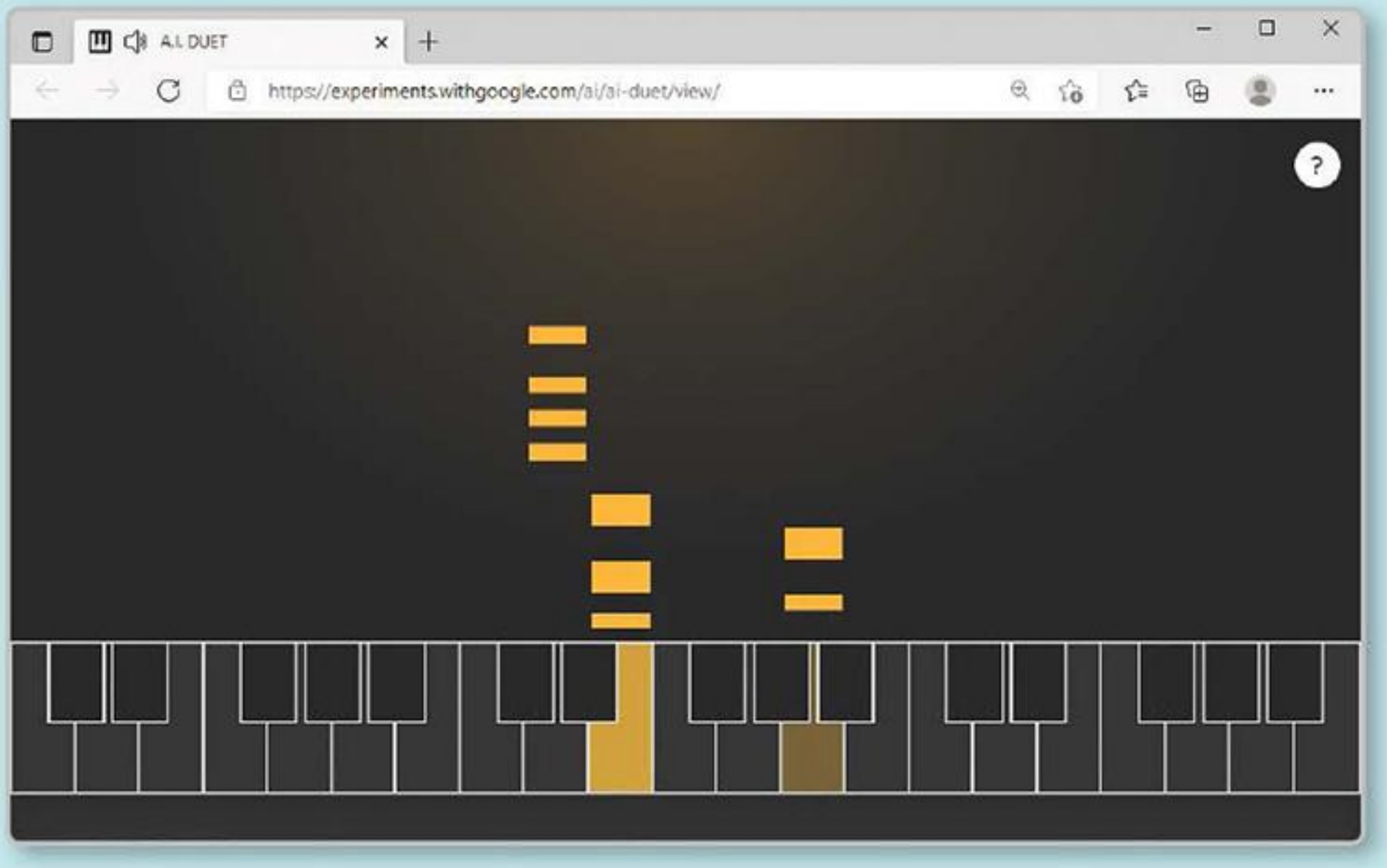
   Click on the **PLAY** button. The game is ready to play.



Press any key by using the mouse or keyboard.



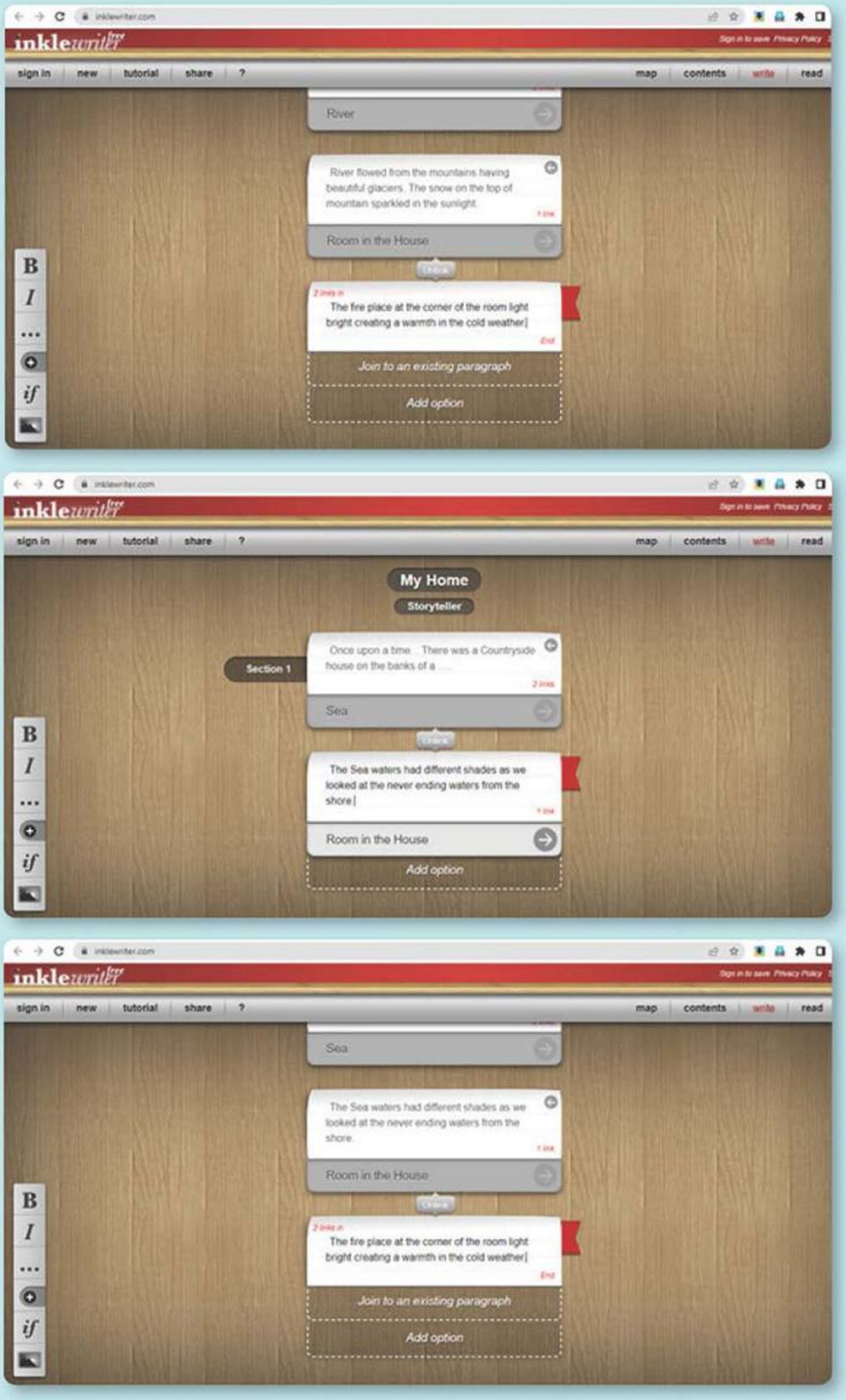
Computer will start responding you according to the key you pressed with yellow colour.



This experiment learns from your input and gives the response. There is no pre-programed code for this experiment.

5. Draw a floor plan of a Home/School/City and write an interactive story around it using Inklewriter. https://www.inklewriter.com/

Inklewriter is an open-source application used to create and publish interactive stories. For example:



Based on Inklewriter answer the following questions:

(a) What happens if you don't select any of the given options?

(b) Can the user alter or add a new option in the story?

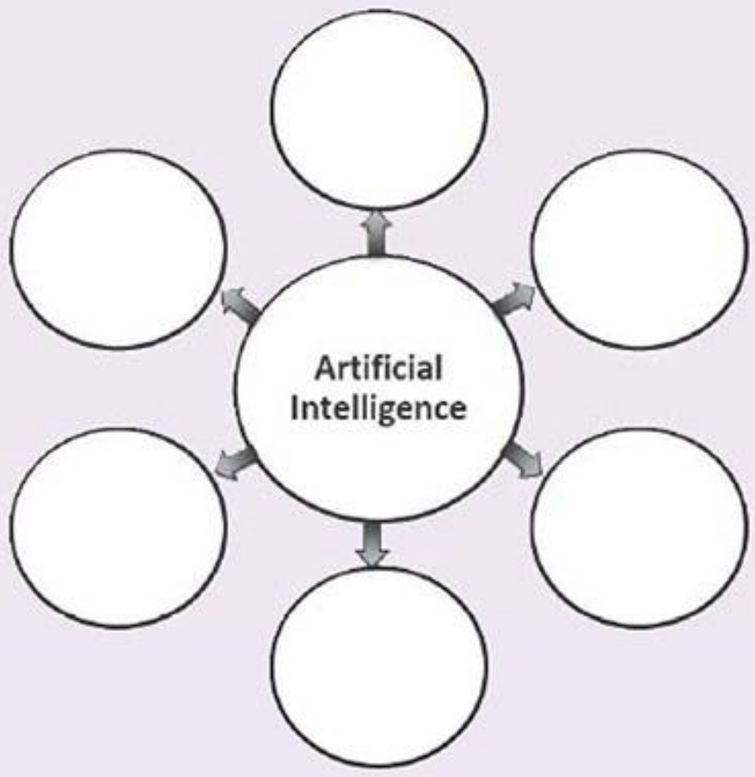
(c) Can you connect two different plots of the story together?

(d) Give reasons explaining why Inklewriter is using AI.

Class Activity

#Experiential Learning

1. How do you think Artificial Intelligence can help you as you go about your daily life? Fill in your ideas below: [CBSE Handbook]



2. Language Understanding (LUIS)

   Language Understanding (LUIS) is a cloud-based AI service from Microsoft Azure that interprets natural language inputs. It identifies user intents and extracts relevant information (entities) from the text, enabling applications to understand and respond to user queries effectively. LUIS offers customisable models, pre-built domains, and continuous learning capabilities to improve accuracy over time. It integrates seamlessly with other Azure services, facilitating the creation of intelligent bots and applications for various use cases like customer service, virtual assistants, and home automation.

   Visit the https://www.luis.ai/ link and make a statement about either of the following:

   - Book me a flight to Cairo
   - Order me 2 pizzas
   - Remind me to call my dad tomorrow
   - Where is the nearest club?

   Share how LUIS has interpreted your statement.

   _____

   _____

Answers

Exercise (Section A)

A. 1. d 2. c 3. a 4. c 5. d 6. c 7. d 8. d 9. c 10. a
11. a 12. a 13. a 14. b

B. 1. Portrait Mode 2. Super AI 3. driverless vehicles 4. data
5. Boston 6. Herbert Simon / Allen Newell 7. Computer Vision
8. Elon Musk 9. theme 10. shortest routes 11. Plantix 12. Chatbots
13. See & Spray 14. System map 15. Monitoring

C. 1. False 2. True 3. True 4. True 5. True
6. True 7. True 8. False 9. True 10. False
11. True 12. True 13. True 14. False 15. False

D. 1. f 2. e 3. a 4. b 5. c 6. d

Answer the following questions:

1. You have often heard that the development in the field of artificial intelligence will lead to ethical issues. Do you agree?

2. The main objective of developing AI systems is to act and behave like a human being. Since humans are unpredictable and emotional, should we also make AI systems unpredictable and emotional?

3. Is it possible data features influence the accuracy of an AI model?

4. We must limit the use of smartphones as the various apps can collect and misuse our data. Do you agree? Why?

UNIT-2

DATA LITERACY

Learning Outcomes

- Defining Data Literacy
- Why is Data Literacy Essential?
- How to Become Data Literate?
- Data Security and Privacy
- Data Acquisition/Acquiring Data
- Data Processing and Data Interpretation
- Types of Data Interpretation
- Using Tableau for Data Presentation
- Data Pyramid and Its Different Stages
- Impact of Data Literacy
- Data Literacy Process Framework
- Acquiring, Processing, and Interpreting Data
- Usability, Features, and Preprocessing of Data
- Methods of Data Interpretation
- Importance of Data Interpretation

Data refers to any collection of raw facts, figures, or statistics that can be stored and processed by a computer. It can be in different forms, like numbers, text, images, audio, and video etc.

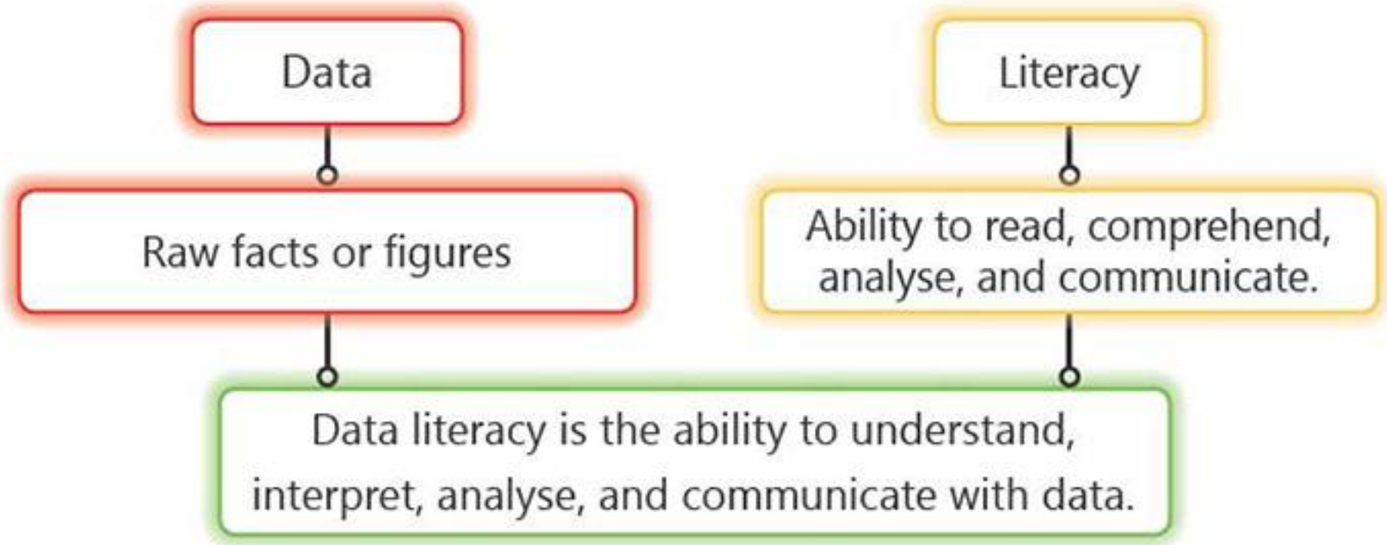
Defining Data Literacy

Literacy refers to the ability to read, comprehend, and use information effectively.

Data + Literacy = Data Literacy

Data literacy means knowing how to understand, work with, and talks about data. It's about being able to collect, analyse, and show data in ways that make sense.

Data literacy is essential because it enables individuals to make informed decisions, think critically, solve problems, and innovate.



#Digital Literacy

Video Session

Scan the QR code or visit the following link to understand the Data Literacy:

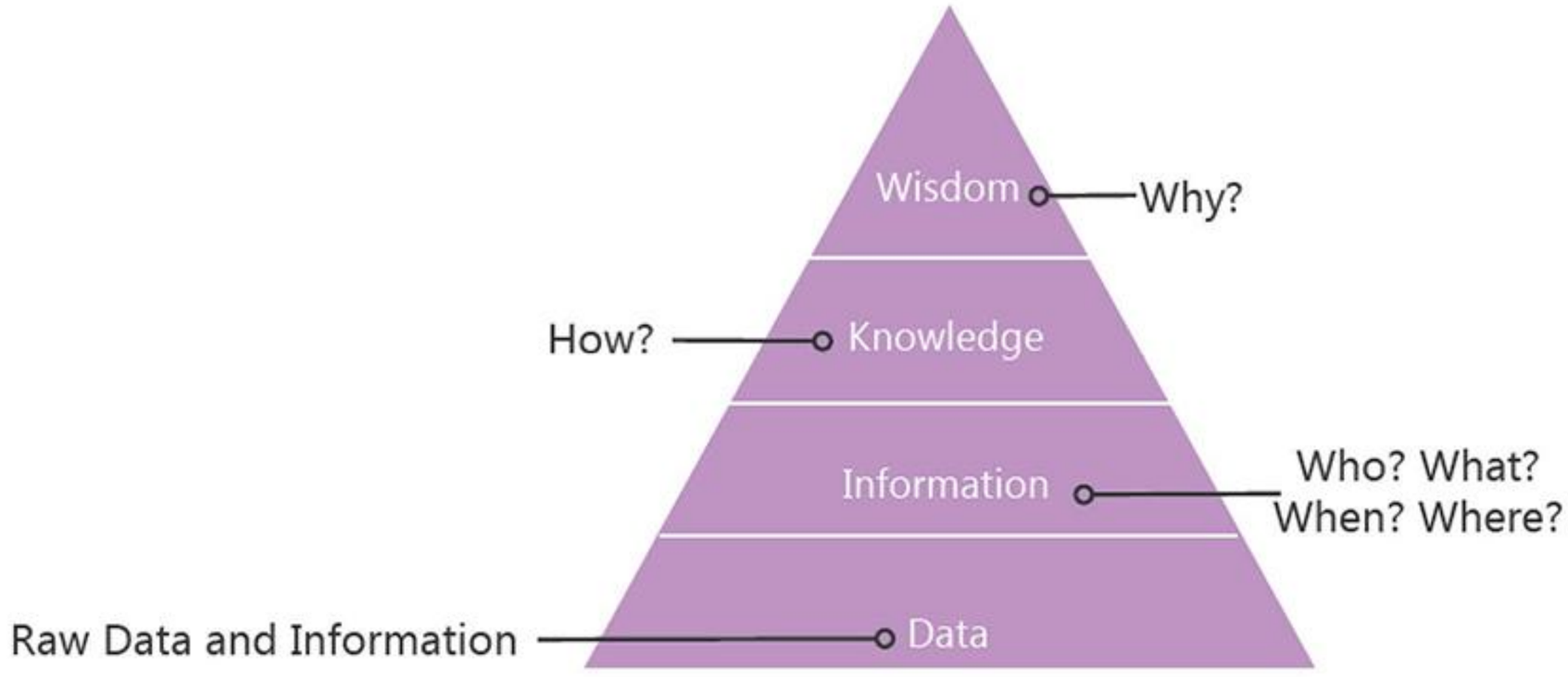
https://www.youtube.com/watch?v=yhO_t-c3yJY

1. What are the takeaway from the given video?

2. What is the definition of data and data literacy, and how do these concepts impact our ability to understand and use information effectively?

Data Pyramid and Its Different Stages

The data pyramid is a conceptual model that illustrates the hierarchical structure of data processing, depicting the progressive transformation of raw data into actionable wisdom. It starts with raw **data**, which initially has no use. Through processing and analysis, this data evolves into meaningful **information**, then **knowledge**, and ultimately **wisdom**. This transformation enables informed decision-making and a deeper understanding of the world around us.

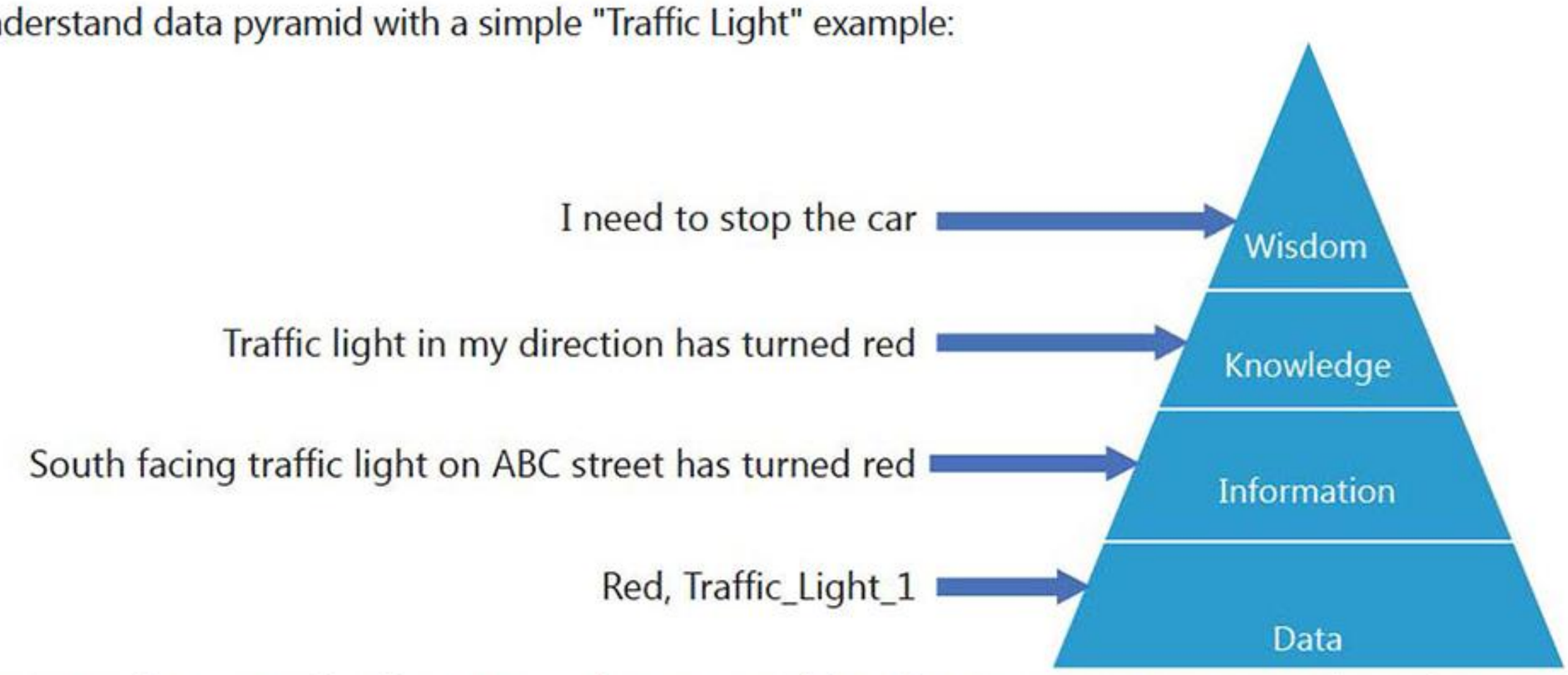


Different Stages of the Data Pyramid

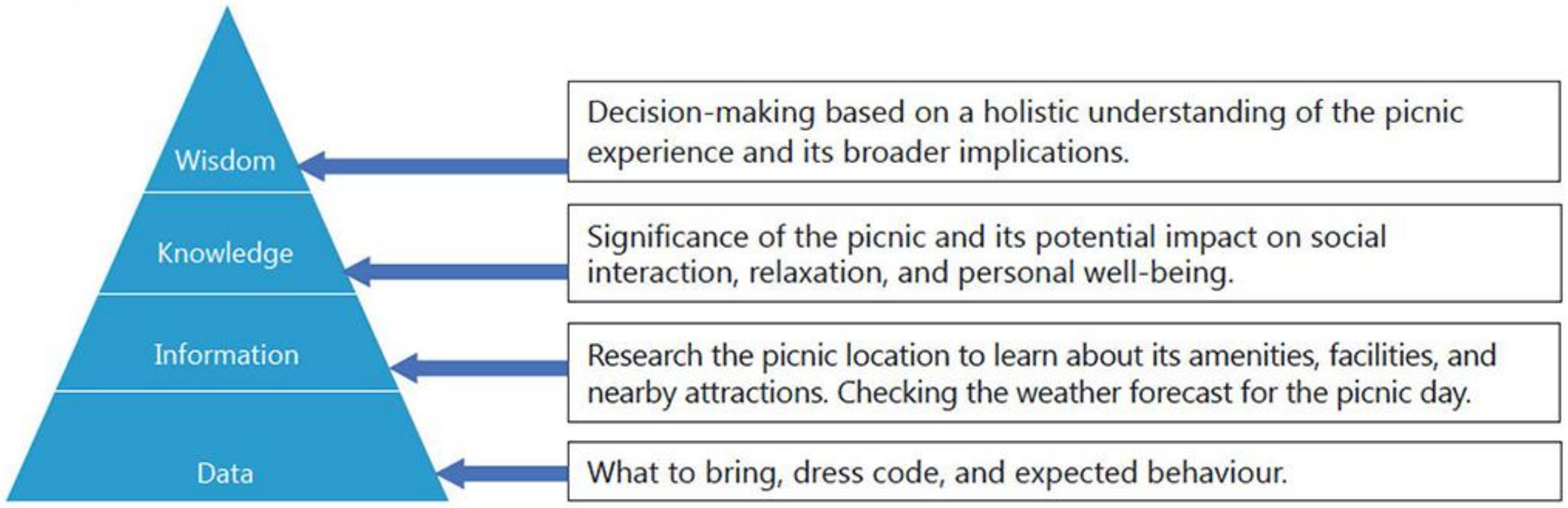
The DIKW pyramid represents the relationships between data, information, knowledge, and wisdom. Each building block is a step towards a higher level - first comes data, then is information, next is knowledge, and finally comes wisdom. Each step answers different questions about the initial data and adds value to it. Let's learn about them.

- **Data (Base Level)**
  - In this stage data is in its most basic form, unprocessed and unstructured.
  - It has no meaning and is not very useful in this form.
- **Information**
  - It is a processed data that collectively carries a logical meaning.
  - It is obtained by analysing raw data to make it easier to measure, visualise, and analyse for decision-making.
  - By asking relevant questions about 'who', 'what', 'when', 'where', etc., we can derive valuable information from the data and make it more useful for us.
- **Knowledge**
  - It is useful information that leads to a deeper understanding.
  - It represents a more profound comprehension of **how** things happen.
  - It is the ability to use information to achieve desired output.
- **Wisdom (Top Level)**
  - It represents the highest level of understanding. Wisdom is knowledge applied in action.
  - It is the ability to understand why things are happening in a particular way.
  - It involves critical thinking to interpret data and make good consistent decisions.

Let's understand data pyramid with a simple "Traffic Light" example:



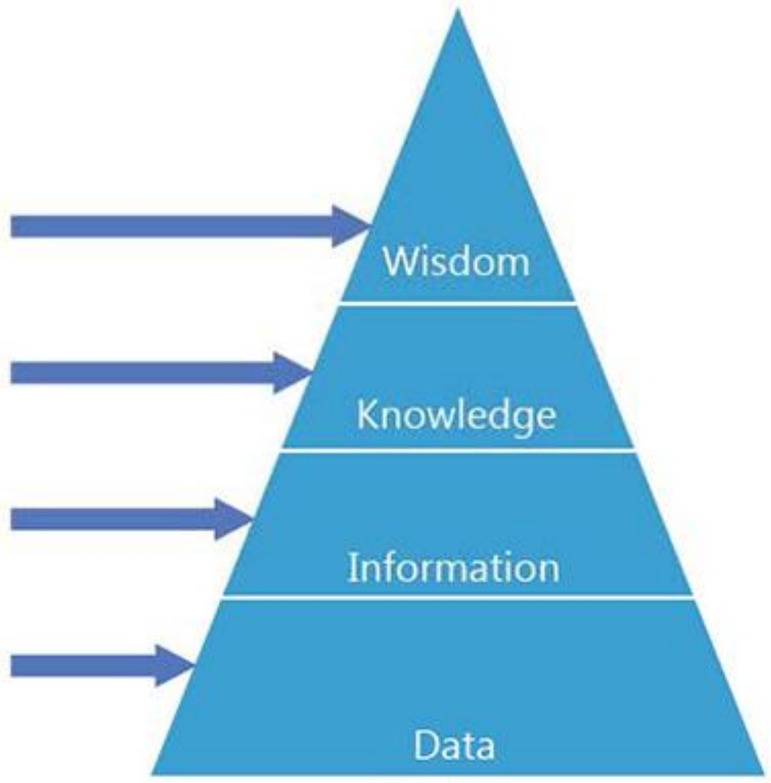
Let us see another example of creating a data pyramid for planning a picnic as a student after receiving the official letter from school:



Ai Task

#Digital Literacy

Can you try another example of creating a data pyramid for preparing a speech on the occasion of "Technology Day"?



Sudha attended three consecutive presentations and rated them as follows:

- the first was 'outstanding'
- the second was 'poor'
- the third was 'satisfactory'

Can you filter the data from this statement? Are the ratings of the same type?

Why is Data Literacy Essential?

Data literacy can equip individuals with skills and knowledge to improvise in a tech and data-driven world. There are countless reasons why data literacy is critical to an organisation. Some of these are:

- Data literacy enhances **decision-making ability** in individuals based on evidence. Based on sources of data, emerging trends and interpretations, individuals can make decisions that are data-driven.
- Data literacy is able to cultivate **critical thinking** skills to understand and explore data's implications by questioning assumptions, reaching logical conclusions, identifying patterns, and evaluating evidence and data accuracy.

- Data literacy helps in **analytically producing solutions** to problems that help people develop critical thinking skills. It enables user to tackle complex problems and derive meaningful relevance.
- Data literacy fuels **innovation** by providing tools and techniques to explore data from different perspectives. It helps in innovating to meet the requirements of emerging trends and market demands.

Impact of Data Literacy

Data literacy has an immense impact on various aspects of society, like business, education, healthcare, and public policy, as given below:

- **Business:** It can lead to growth and innovation and help companies maintain their competitive edge in a tech-focused world. Data literate employees can effectively analyse data to gain insights into market trends, customer behaviours, and operational performance.
- **Education:** It empowers the teaching-learning process. In the field of education, data literacy is essential for both students and educators. Students can better understand and analyse information, while educators can use data to tailor instruction and identify areas where students may need additional support. Students can engage more deeply with course material, particularly in STEM fields.
- **Healthcare:** Healthcare professionals can use data to improve diagnostics, treatment plans, and patient monitoring. Hospitals and clinics can use data to optimise resource allocation, reduce waste, and improve operational efficiency.
- **Public policy:** Policymakers can use data to design, implement, and evaluate policies more effectively. Data literacy promotes transparency, allowing the public to hold policymakers accountable through data-driven evidence.
- **Social equity:** Data literacy can highlight disparities in areas such as education, healthcare, and employment and can promote social equity. It helps ensure that resources are distributed effectively to areas of greatest need.

Ai Task

#Problem Solving & Logical Reasoning

Let us do an activity to understand the impact of data literacy.

Impact of News Articles (Select any trending news)

Session Preparation Logistics:

For a class of 40 Students [Pair Activity]

Materials Required:

Item	Quantity
Online Data Sources Clues	NA
Computers	20

Purpose:

The purpose of this activity is to engage participants in various scenarios that involve collecting data and analysing its sources. Emphasising the importance of validating data sources, the aim is to instil the concept of data literacy. By understanding how authentic data sources contribute to reliable and unbiased decision-making, participants will develop critical skills for navigating and interpreting data effectively.

Brief: [Pair Activity]

Participants will search the internet for data sources, extracting key information to support their decisions.

Author of the Source	Weblink to the Source	How was the situation described by the Source	Key figures in the source

You have to rank the sources of the news articles from most accurate to least, state reasons for your choice.

Rank	Data Source	Remarks

So, we can conclude that every data tells a story, but we must be careful before believing the story.

How to Become Data Literate?

Data literate is a person who can interact with data to understand the world around them and derive meaningful information from data. Some key points that will help you become a data literate are as follows:

- **Data identification and sourcing:** Identify the source of data to find whether the data is reliable or not.
- **Understand the basics**: Learn the concepts of data, types of data, and how it can be used as not all data is suitable for every kind of analysis.
- **Learn data analysis tools**: There are many data analysis apps available that can be learned in order to understand the impact of the right data. Analysis involves using statistical tools or software to interpret the data. This can include calculating simple averages for more complex tasks.
- **Gain statistical knowledge**: Statistics play a vital role in data literacy. It's one of the vital components that must be learned before you dive into the data-driven world.
- **Use data visualisation**: Understand the techniques of data visualisation graphics, and charts. Tools like tableau, matplotlib, and python can be used effectively.
- **Learn data manipulation**: Understanding how to manipulate data to meet the requirements is also one of the key factors. Methods like filtering, sorting, grouping, and omitting are essential for extracting insights from large dataset.
- **Practise data cleaning**: Learning to remove data redundancy and data inaccuracy is essential to being data literate. This may include dealing with missing values, removing outliers, or transforming data into a format suitable for analysis.

Ai Reboot

1. What does the term "data literacy" mean?

   _____

2. What makes data literacy indispensable?

   _____

Ai Task

#Creativity & Innovativeness

Let us do an activity:

Scenario: Buying a video game online.

Data literacy helps people research products while shopping over the Internet.

How do you decide the following things when you are shopping online?

1. Which is the cheapest product available?

   _____

2. Which product is liked by the users the most?

   _____

3. Does a particular product meet all the requirements?

   _____

4. When will the product delivered?

   _____

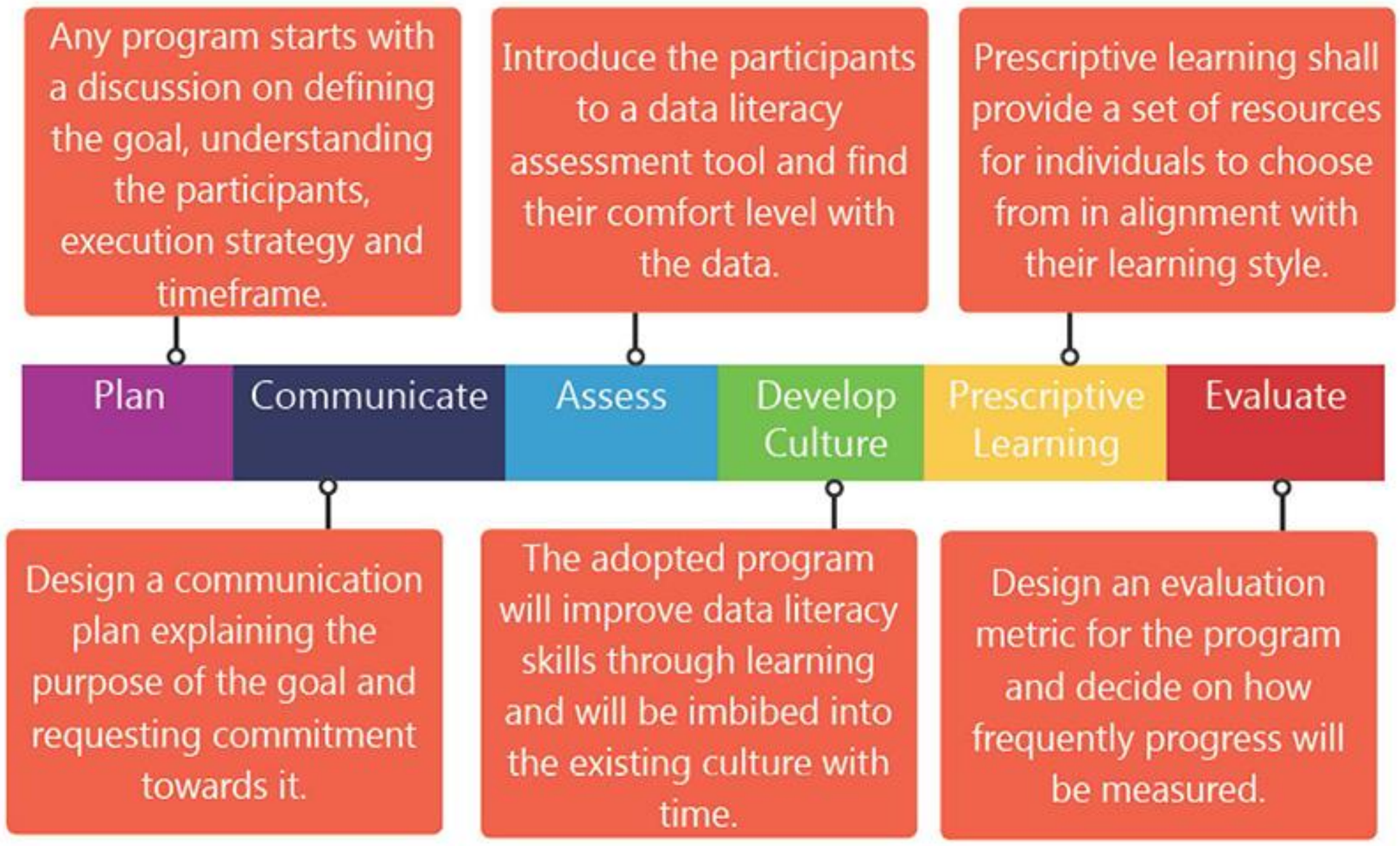
A data literate person can:

- Filter the category as per the requirement – If the budget is low, select the price filter as low to high.
- Evaluate the reviews and ratings to have a better understanding of the product by checking the user ratings of the products.
- Check for specific requirements in the product.

Data Literacy Process Framework

The data literacy framework provides a comprehensive and structured approach to develop the necessary skills for using data efficiently and with all levels of awareness. Each level builds upon the previous one, fostering a deeper and more understanding ability to work with data.

Here are the typical levels of awareness in a Data Literacy Process Framework:



Plan

Planning sets a clear roadmap and structured approach to enhance data literacy across different levels of awareness. You can:

- define the specific and measurable goals.
- develop a timeline and milestones for achieving these goals.
- identify and allocate resources needed (e.g., budget, tools, personnel).

Communication

Clear and consistent communication about data literacy will ensure an efficient data literacy framework within an organisation. This involves:

- designing a well-formulated communication plan to explain the purpose of the goal and requesting commitment from the team towards it.
- sharing stories and case studies that demonstrate the positive impact of data literacy. It will help in motivating and encouraging the team.
- monitoring continuously the effectiveness of communication efforts and make adjustments as needed. It will help in minimising the risk of any associated costs.

Assess

Introducing participants to data literacy assessment tools and finding out how comfortable they are with data is crucial in data literacy program. This process will help to:

- see what skills they already have
- identify what they need to learn
- create customised training plans for them.

Develop Culture

To integrate data literacy skills into the organisational culture, it is important to make data-driven decision-making a fundamental part of everyday work. This will help:

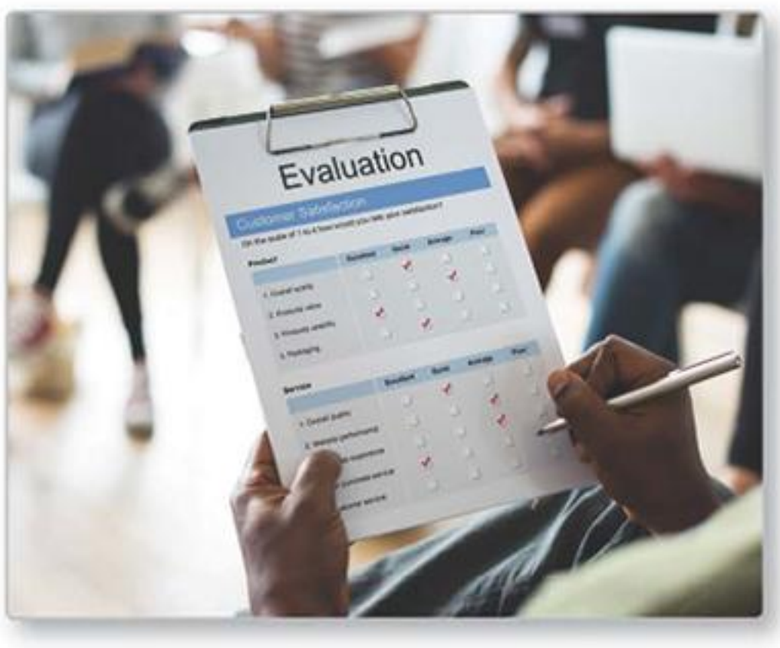
- leaders play a crucial role in fostering this data-driven culture in an organisation.
- in training programs to build data literacy skills through learning across all levels.
- in encouraging a collaborative environment that will lead to imbibing this new culture into the existing culture with time.

Prescriptive Learning

Prescriptive learning refers to an educational approach that focuses on guiding students towards specific outcomes or behaviours through structured instruction and targeted interventions based on data and analysis of their learning needs.

By implementing a prescriptive learning approach, organisations can provide a set of diverse resources that align with individual learning styles. This approach ensures that there is:

- customised learning journeys tailored according to different people(for example, different educational backgrounds) based on individual needs and preferences.
- a variety of learning materials that cater to different learning styles and help in easier grasping of concepts.
- enough leverage or advantage to the learners to progress at their own pace, accommodating their schedules and learning speeds.
- create an environment that makes learners feel comfortable and gain new skills in an environment to supports continuous learning and encourages self-directed exploration.
- each participant can choose the materials and methods that work best for them, leading to more effective learning and greater improvement in data literacy skills over time.



Evaluate

Designing an evaluation metric for the data literacy program involves creating a structured framework to assess participants' progress and the effectiveness of the program overall. It helps to:

- improve participants' overall data literacy skills.
- establish clear criteria to measure the success of the data literacy program and individual participant growth.
- establish a schedule for assessing participant progress to monitor their development over time.

Data Literacy Framework—An Iterative Process

This means the development and enhancement of data literacy skills are not static or one-time event. Instead, they evolve through continuous cycles of learning, application, and refinement.

- **Learning**
  - ✶ Learning is the initial stage where individuals acquire new knowledge and skills related to data literacy.
  - ✶ Individuals engage in various learning activities, such as formal training sessions, online courses, reading materials, and hands-on workshops to gain insights into data concepts, tools, and methodologies.
- **Application**
  - ✶ Application involves putting acquired knowledge and skills into practice in real-world contexts.
  - ✶ Individuals apply what they have learned to analyse real datasets, solve data-related problems, and make informed decisions.
  - ✶ They are engaged in data projects, experiments, or simulations to gain practical experience and develop a deeper understanding of data concepts.
- **Refinement**
  - ✶ Refinement focuses on reflecting the past experiences, identifying areas for improvement, and enhancing data literacy skills over time.
  - ✶ Feedback from peers, mentors, supervisors, and outcomes of data-related activities informs the refinement process, guiding individuals to adjust their practices accordingly.

Ai Reboot

List down the levels of data literacy process framework.

Data Security and Privacy

The terms data security and data privacy are often used interchangeably, but they mean different things. Data privacy determines who can access the data, while data security involves tools and policies to restrict access to the data.

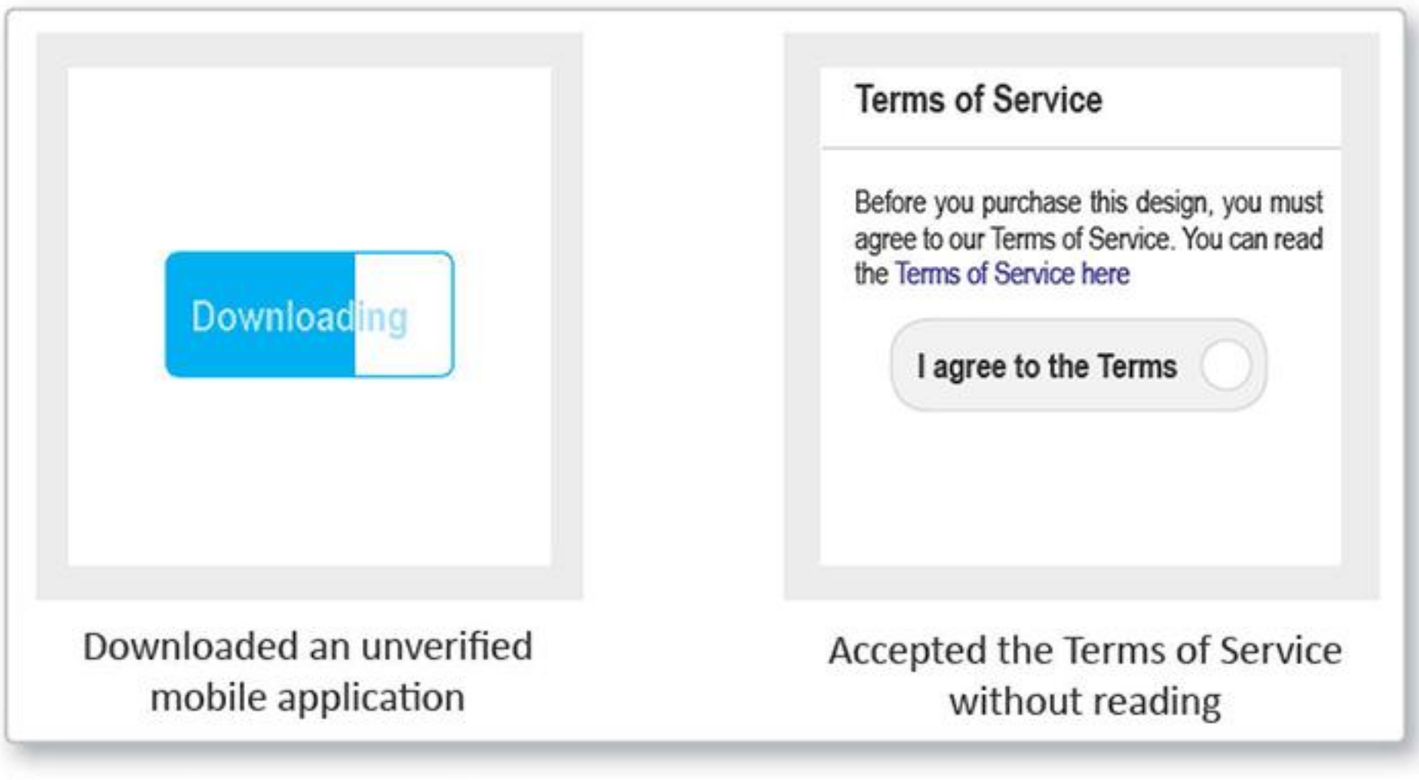
Data Privacy	It is governing how data is collected, shared, and used.
Data Security	It is protecting data from attackers who might want to misuse it.

What is Data Privacy?

Data privacy referred to as information privacy is concerned with the proper handling, processing, storage, and usage of sensitive data including personal data and other confidential data, such as certain financial data and intellectual property data, to meet regulatory requirements as well as protecting the confidentiality and immutability of the data.

So, when we talk of data privacy, it is expected that any platform or individuals who have access to this information ensure that data is used in a way that respects and fulfils legal requirements and compliance of handling privacy rights. These include how the data is collected and shared for usage and who all have access to data.

Given below are two examples which may compromise our data privacy.



Downloaded an unverified mobile application

Accepted the Terms of Service without reading

Why is Data Privacy Important?

Data privacy is important because:

- a data breach at a government agency can put top secret information in the hands of an enemy country.
- a data breach at a hospital can put personal health information in the hands of those who might misuse it.
- a data breach at a corporation can cause put proprietary data in the hands of a competitor.
- a data breach at a school can inconvenience to the parents, by getting continuous calls from tuition and coaching centers cause annoyance and stress.

The following best practices can help you ensure data privacy:

- Understanding what data you have collected, how it is handled, processed, used, and where it is stored.
- Only necessary data required for a project should be collected.
- User consent while data collection must be of utmost importance.

What is Data Security?

Data security involves safeguarding digital information from unauthorised access, corruption, or theft throughout its entire lifecycle. Essentially, security means protecting anything from theft and misuse. Data security is related to securing sensitive data. It aims to prevent unauthorised access, theft, or corruption of data, regardless of whether the data is personal or not. Systems and networks must be established to prevent malicious and fraudulent activities from harming, destroying, misusing, or stealing crucial digital data.

Why is Data Security Important?

Cyber attacks are becoming more frequent as a result of the growing volume of data stored in the cloud. The best course of action given the volume of traffic being produced is to regulate and secure the transmission of private or sensitive data everywhere, that it is known to exist. Avoid entering sensitive information, such as your address, PAN, or Aadhar number on unrecognised and unsafe websites.

The most possible reasons why data security is more important now are:

- A constant fear cyberattacks affect all people.
- The fast-technological changes will boom cyberattacks.
- A persistent fear everyone is impacted by cyberattacks.
- Rapid technical advancements will increase the frequency of cyberattacks.

Types of Data Security Controls

Different types of data security controls are as follows:

- **Strong Passwords:** A strong password is a combination of atleast 8 characters with upper and lower-case letters, numbers, and special characters that is difficult for unauthorised individuals or automated programs to guess or crack. It is a very basic step that one should take and never share the same with even the most trusted ones. Avoid using birth dates, anniversary dates, and common combinations of numbers.

  Some examples of strong passwords are: m#P52s@ap$V, "N4&vQ2! p".

- **Authentication:** It also refers to multi-factor authentication (MFA) and is an additional security layer in online data systems. After a user enters their password to log in, MFA requires them to provide one or more additional forms of authentication to verify their identity. This could include one-time generated code as a security token in smartphones or emails or a fingerprint or facial recognition, or Passwords or PINs.

- **Access Controls:** Access controls refer to the security measures and protocols to restrict access to sensitive data, ensuring that only authorised individuals or entities can view, modify, or interact with it. This reduces the risk of unauthorised access by limiting the number of users who can interact with sensitive data.

- **Data Backup:** Data backup refers to the process of creating copies of data to ensure that it can be restored in the event of data loss due to natural disasters, accidents, cyber-attacks, or other unexpected events. Sometimes physical backup media is used to secure in access-controlled environments. Another method to secure data can be the cloud backup which is considered more reliable.

- **Encryption:** Encryption is a security technique that transforms readable data (plaintext) into an unreadable format (ciphertext) using an algorithm and an encryption key. This process ensures that only authorised individuals with the correct decryption key can access the original data. Encrypted data is meaningless if captured by attackers.

- **Data Disposal:** Data disposal refers to the process of securely destroying or deleting data that is no longer needed to prevent unauthorised access, recovery, and misuse. Proper data disposal practices are essential to ensure that sensitive and confidential information does not fall into the wrong hands. Paper documents, CDs, DVDs, and other physical media can be shredded to render them unreadable. It is also referred as data erasure or data destruction.

- **Firewall and Antivirus Software:** Using firewall and antivirus software can stop and alert users of any suspicious activity happening on their devices. With the timely updated versions of the same, can go a long way in ensuring data security. Firewalls use pre-configured rules to inspect all the packets entering and exiting a network and, therefore, help stop malware and other unauthorised traffic from connecting to devices on a network.

- **Data Masking:** It obscures data so that, even if criminals exfiltrate it, they can't make sense of what they stole. Unlike encryption, which uses encryption algorithms to encode data, data masking involves replacing legitimate data with similar but fake data. This data can also be used by the company in scenarios where using real data isn't required, such as for software testing or user training.

- **Training:** Corporates must take up regular Data Security sessions of their staff to sensitise them about following the data protection processes being implemented and the importance of doing so. Making them conscious of suspicious emails, links that they might receive, not leaving their devices unlocked when unattended, keeping software's up to date and not sharing passwords, are some of the things that can be taken up.
- **Audits and Testing of Security System:** Regular audits and testing of security policies, integrated malware protection, firewalls, Wi-Fi connections security, Hardware-based security, checking applications security, email security and compliance also play very important role in maintaining data privacy and providing data security.
- **Other Basic Preventions:** Being aware of surroundings and threats from insiders, complying with security regulations which might be shared by entrusted agencies or bodies which track online cyber activities all across the world are few other ways to provide cyber security.

Differences between Data Security and Data Privacy

Data Privacy	Data Security
Data privacy ensures the ethical and lawful use of data.	Data security ensures the protection of data from unauthorised access and breaches.
It focuses on how data is collected, used, shared, and stored so that the rights of individuals over their data is protected.	It focuses on safeguarding personal data, business data, intellectual property, and many more from various threats.

How are Data Security and Data Privacy related to AI?

Data security and data privacy are crucial components of Artificial Intelligence (AI).

Data Security in AI

AI systems often rely on vast amounts of data for training and operation. Unauthorised access and tampering could lead to inaccurate AI models and compromised outcomes. Many AI applications process sensitive data, such as personal, financial, or health-related information. Strong data security measures can stop data breaches and unauthorised access.

Data Privacy in AI

Data privacy brings the ethical use of AI. This ensures that AI systems comply with data privacy laws and regulations (such as GDPR, CCPA) to help protect individuals' rights and maintain public trust. AI systems must ensure that data is collected, shared, and used in ways that users have explicitly consented to, maintaining transparency and trust.

Best Practices for Cyber Security

Cybercrime is undoubtedly one of the fastest-growing crimes in the world and it continues in all industries. To stay protected from cyberattacks, one needs to be aware of the most up-to-date cyber security tips and best practices. Cyber security involves protecting computers, servers, mobile devices, electronic systems, networks, and data from harmful attacks. The best practices for cyber security are constantly evolving to keep up with the cyber threats.
Reference Links:

#Interdisciplinary

Video Session

Scan the QR code or visit the following link to understand the Internet safety tip for online security:

https://www.youtube.com/watch?v=aO858HyFbKI

What are some key takeaways from the video session on online security, specifically regarding best practices for protecting personal information?

Ai Task

#Ethical & Moral Reasoning

Refer the given link and answer the following questions:

https://www.cbse.gov.in/cbsenew/documents/Cyber%20Safety.pdf

1. What are the key online security practices discussed in the PDF that can help protect personal information from cyber threats?

2. What essential digital etiquette guidelines were highlighted in the PDF to ensure respectful and effective online communication?

The following is the list of **Do's** and **Don't 's** to be followed for best practices of cyber security:

Do's	Don't's
• Use strong, unique passwords with a mix of characters for each account. • Activate Two-Factor Authentication (2FA) for added security. • Download software from trusted sources only and scan files before opening. • Prioritise websites with "https://" for secure logins. • Keep your browser, OS, and antivirus updated. • Adjust social media privacy settings for limited visibility to close contacts. • Always lock your screen when away. • Connect only with trusted individuals online. • Use secure Wi-Fi networks. • Report online bullying to a trusted adult immediately. • Do use privacy settings on social media sites to restrict access to your personal information.	• Avoid sharing personal info like real name or phone number. • Don't send pictures to strangers or post them on social media. • Don't open emails or attachments from unknown sources. • Ignore suspicious requests for personal info like bank account details. • Keep passwords and security questions private. • Don't use copyright software without permission. • Avoid cyberbullying or use of offensive language online. • Don't respond to phone calls or emails, asking for confidential data. • Don't leave wireless or Bluetooth turned on when not in use.

Ai Reboot

1. How are data security and data privacy related?

2. List down practices that can help you ensure data privacy.

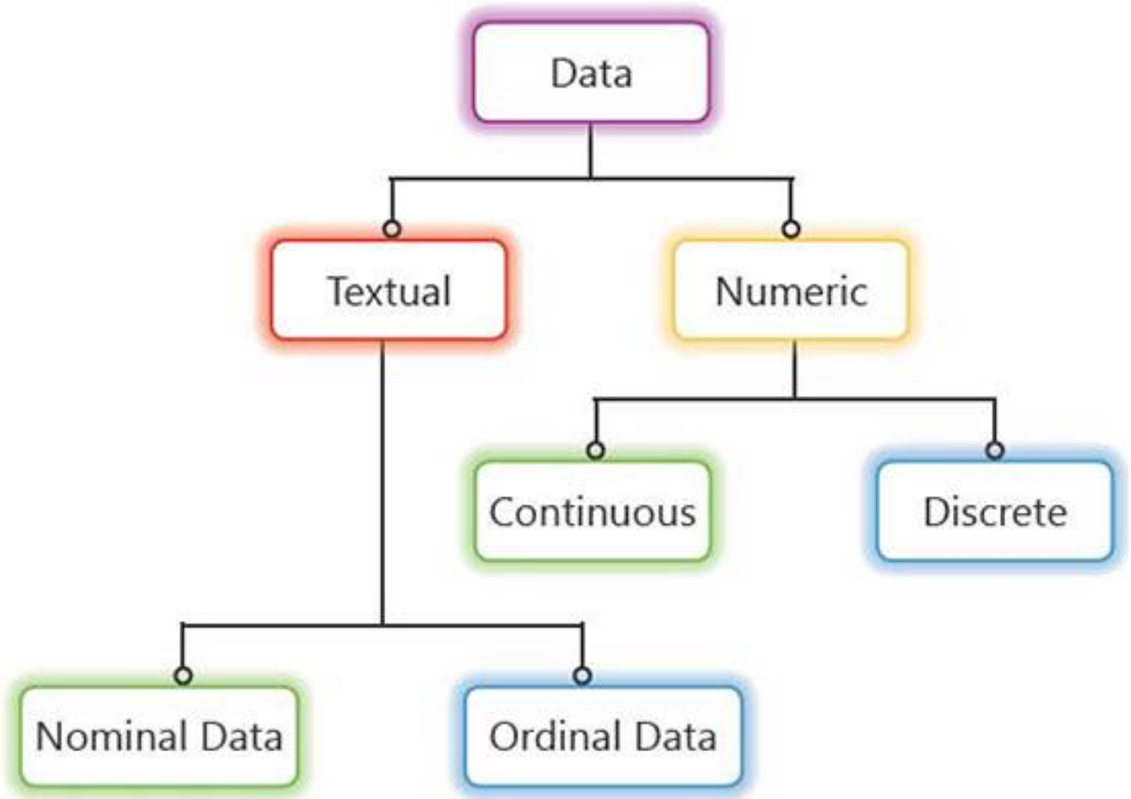
Acquiring, Processing, and Interpreting Data

Working with data involves three key steps: **acquiring, processing, and interpreting**. First, gather data from sources like surveys and databases. Next, process it by cleaning and organising it for accuracy. Finally, analyse the data to find patterns and insights that help make informed decisions.

Types of Data

In statistics, various types of data are gathered, analysed, interpreted, and presented. These data consist of individual factual pieces recorded for analysis. Data analysis involves interpretation and presentation, producing statistics to get some meaningful insight from that data. Data classification and handling are crucial processes that use multiple tags and labels to define data, ensuring its integrity and confidentiality. Artificial Intelligence is crucial, with data serving as its foundation. We come across different types of data and information every day.

Data can be broadly classified under Textual data and Numeric Data as explained.



Textual Data (Qualitative Data)

Textual data is the information that is written or expressed using words and language. It includes things like articles, books, emails, messages, and any other written content. Instead of numbers, it's made up of letters, words, and sentences that convey meaning and information. Qualitative data is also called **categorical data**.

For example, "Learning AI is fun."

Qualitative data is further classified into two types that includes,

- Nominal data
- Ordinal data

Nominal Data

It consists of categories or names that cannot be ordered or ranked. Nominal data is often used to categorize observations into groups, and the groups are not comparable. Examples of nominal data include gender (Male or Female), and blood type (A, B, AB, O).

Ordinal Data

It consists of categories that can be ordered or ranked. Ordinal data is often used to measure opinions, where there is a natural order to the responses. Examples of ordinal data include education level (Elementary, Middle, High School, College), job position (Manager, Supervisor, Employee), etc.

Numeric Data (Quantitative Data)

Numeric data means information that's in numbers, not words or descriptions. It's often called quantitative data because it's collected as numbers and can be used for math and stats. For instance, if you know the total number of workers and how many are men, you can figure out how many are women by subtracting. This ability to do calculations with numeric data makes it great for doing statistics and analysing data.

For example, marks, temperature, height, weight, etc.

Numeric data can be further classified as:

Continuous Data	Discrete Data
Continuous data can take any numeric value within a specified range.	Discrete data refers to distinct single values. It consists of whole numbers without decimal parts that represent distinct categories or values.
Continuous data is measurable.	Discrete data is countable.
This type of data can be infinitely subdivided and often includes decimal points.	Discrete data cannot be subdivided meaningfully.
Often used to analyse using statistical techniques such as mean, median, standard deviation, and correlation.	It is used to analyse using frequency distributions, bar charts, and probability distributions.
Examples: dimensions of classroom, height, weight, temperature, time, etc.	Examples: number of girls and boys in class, number of subjects in class 9th, count of anything.

Qualitative Data versus Quantitative Data

Quantitative Data	Qualitative Data
Data is depicted in numerical terms.	Data is not depicted in numerical terms.
Can be shown in numbers and variables like ratio, percentage, and more.	Could be about the behavioural attributes of a person, or things.
Examples: 100%, 1:3, 123	Examples: loud behaviour, fair skin, soft quality, and more.

AI Domains and Type of Data

Various types of data are utilised across different domains to train models, make predictions, and generate insights. Here are the types of data commonly used in three key domains of AI:

Natural Language Processing (NLP)

Natural Language Processing (NLP) is a field of Computer Science and a subfield of Artificial Intelligence that aims to make computers understand human language. It's all about teaching, and training computers to understand and work with human language. Types of data used in NLP are:

- **Textual data**: This includes a wide range of written text, such as articles, books, emails, social media posts, web content, PDF files, etc.
- **Audio data:** Audio recordings of spoken language, which are transcribed into textual data.

Computer Vision

Computer Vision is a field of Artificial Intelligence (AI) that uses machine learning and neural networks to teach computers to derive meaningful information from digital images, videos and other visual inputs. It is like giving eyes to computers. It helps them look at pictures and videos from the real world and understand what they're seeing. With Computer Vision, computers can figure out what's in a picture or video, just like we do. They can recognise objects, people, and even actions happening in videos.

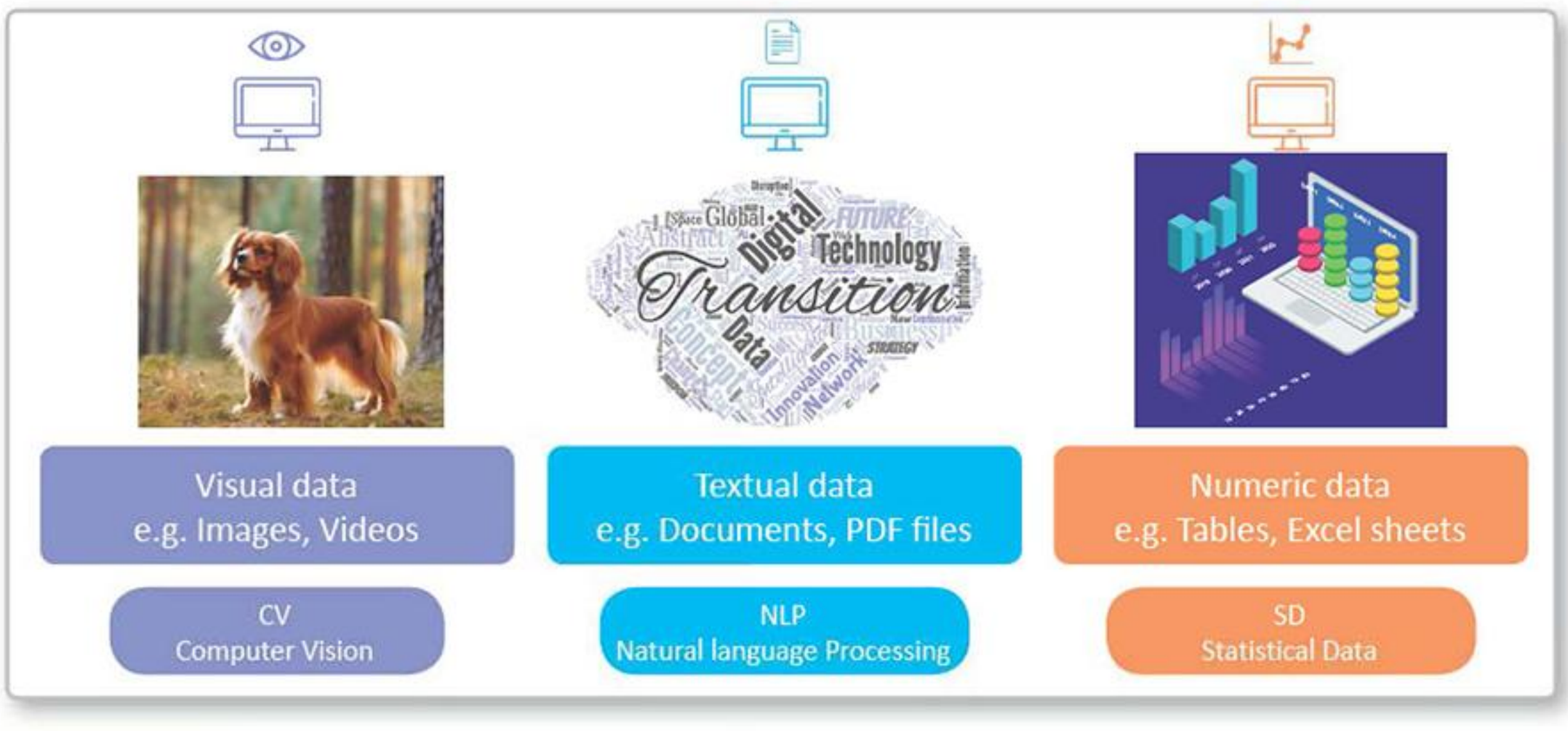
Types of data used in computer vision include:

- **Image data**: Digital images captured by cameras or satellite imagery, medical scans, and surveillance footage.
- **Video data**: Video data captured using camera.

Statistical Data

Statistical data analysis involves collecting, analysing, and interpreting data to discover patterns and insights. It uses structured and time series data for tasks such as hypothesis testing, regression analysis, and predictive modelling. This domain is essential for making data-driven decisions in business, science, and social sciences. Types of data used in statistical analysis are:

- **Numeric data:** Data taken from tables, Excel sheets, etc.
- **Time series data:** Data points collected or recorded at specific time intervals, such as stock prices, weather data, sensor readings, and economic indicators.



Ai Task

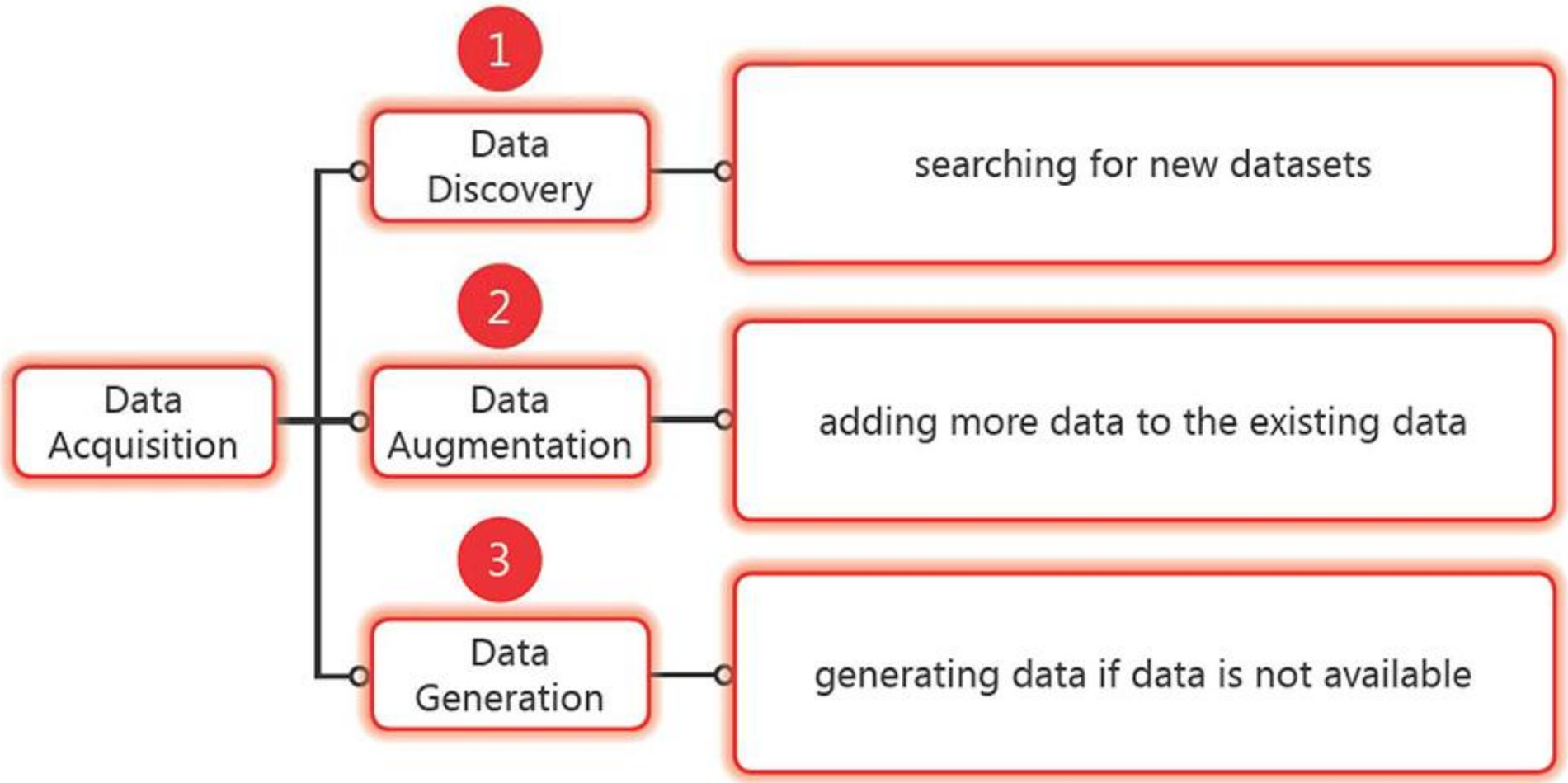
#Experiential Learning

Categorise the given data as textual data (qualitative data) or numeric data (quantitative data)

Data	Categorise
Temperature	
Gender	
Show size	
Comment on social media	
Favourite colour	
Newspaper article	
Population number in a state	
Email	
Heart rate	
Weight of a person	

Data Acquisition/Acquiring Data

Data acquisition, also known as acquiring data, refers to the procedure of gathering data like raw facts, figures or statistics from relevant sources either for reference or for analysis needed in AI projects. This involves searching for datasets suitable for training AI models. The process typically comprises three key steps and plays a crucial role in obtaining and preparing data for analysis.



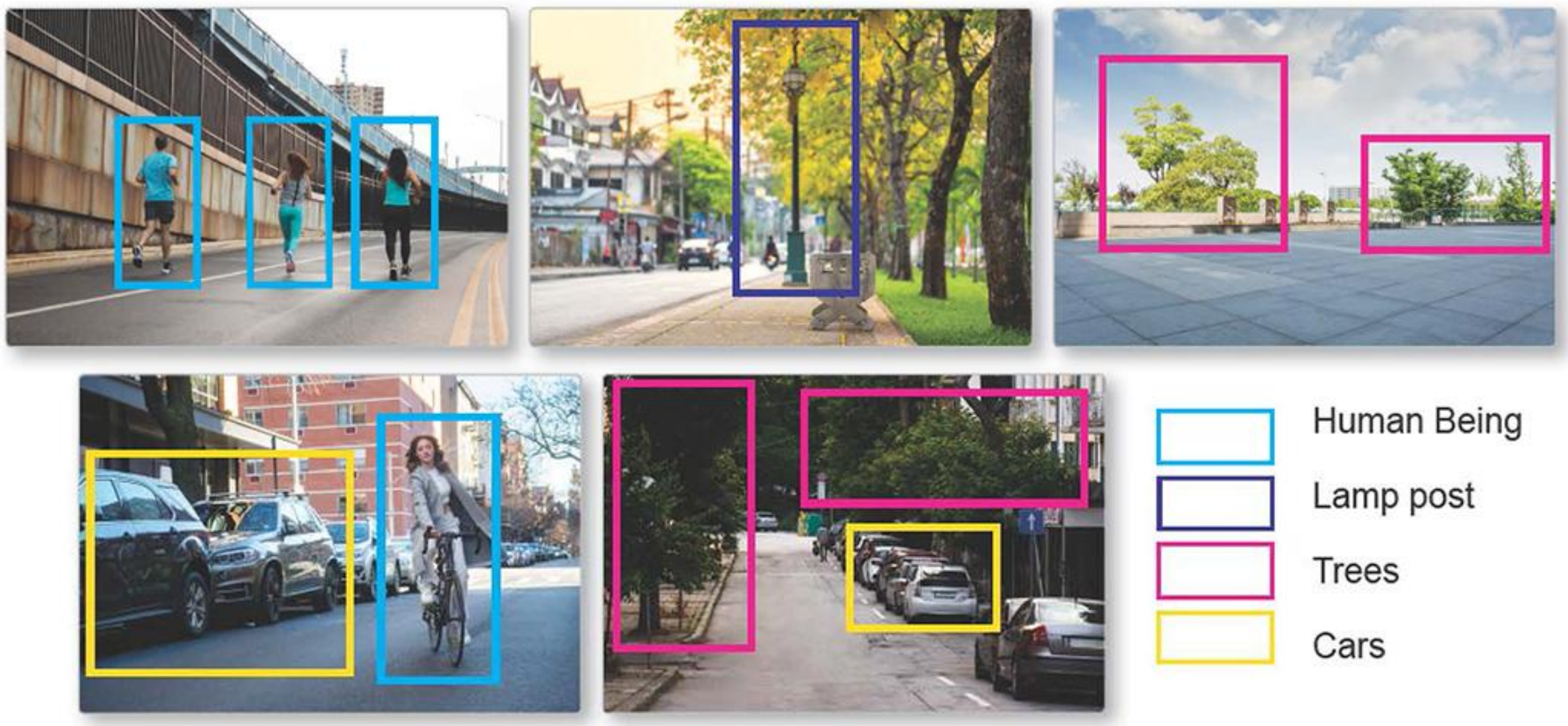
For example, to collect data for making a CV model for a self-driving car.

The three key steps involved in data acquisition are given below:

Step 1: Data Discovery

Data discovery is about hunting for valuable information in different places, checking if it's good quality, and making sense of what we find. In the above example:

- We will require pictures of roads and the objects on roads.
- We can search and download this data from the Internet.



Step 2: Data Augmentation

Data augmentation is the process of increasing the amount and diversity of data. We do not collect new data, rather we transform the already present data. Data augmentation means increasing the amount of data by adding copies of existing data with small changes. The image given here does not change, but we get data on the image by changing different parameters like colour, rotation, flipping and brightness. New data is added by slightly changing the existing data.

In the above example:

- We apply flipping and rotation transformation to create variations of the original images.
- We also simulate occlusions such as objects partially blocking the view to train the model to handle obstructed scenarios.

Step 3: Data Generation

Data generation refers to generating or recording data using sensors. Recording temperature readings of a building is an example of data generation. Recorded data is stored in a computer in a suitable form.

In the above example, of self-driving car. Data acquisition is done for creating fake driving scenarios with different road conditions, traffic patterns, weather, and lighting to cover many possible situations.

Ai Task

#Experiential Learning

Visualise that you are in a big, mysterious forest and searching for hidden treasure.

Write four observations you will be making for finding the treasure and categorise them under the heads viz: data discovery, data augmentation and data generation.

Observations	Categories
1.	.....
2.	.....
3.	.....
4.	.....

Sources of Data Acquisition

Data can be acquired from various sources, classified as either primary or secondary.

Primary Data Sources

The data generated from the experiment is an example of **primary data**. Some of the sources for primary data include surveys, interviews, experiments, etc. Here is an Excel sheet showing the data collected for students of a class.

	A	B	C	D	E	F
1	**Name**	**Gender**	**Address**	**Phone**	**Percentage**	
2	Ridham	Female	A-12 Ramesh Nagar	5555555555	92	
3	John	Male	K-15 Pitampura	5557777888	89	
4	Rohit	Male	G-2 Faridabad	2323232323	90	
5	Gaurav	Male	L-3 Karolbagh	3987678931	87.5	
6						

Secondary Data Sources

Secondary data sources are the external sources for collecting data, rather than generating it personally. Some sources for secondary data collection are: Published Literature, Government Publications, Market research reports, etc.

Best Practices for Acquiring Data

Acquiring data effectively is crucial for ensuring its accuracy, reliability, and usability. Here are some best practices for acquiring data:

1. **Set Clear Goals:** Understand why you need the data and what you want to achieve; specify the type, format, and detail level required.
2. **Identify Data Sources:** Use primary data that you collect yourself (surveys, interviews) and secondary data from others (reports, databases).
3. **Evaluate Sources:** Ensure data sources are trustworthy, relevant, accurate, and current; get necessary permissions and respect privacy.
4. **Collect and Prepare Data:** Use surveys, interviews, sensors, and web scraping; clean data by fixing errors, removing duplicates, and anonymising.
5. **Validate, Document, and Store:** Cross-check and sample for accuracy, keep detailed records and meta-data, store data securely, and regularly update it while following laws and regulations.

Checklist of Factors that make Data Good or Bad

Here's a checklist of factors that can help determine whether data is of good quality (good) data or poor quality (bad) data:

Good Data

- Data is well structured
- It is accurate
- It is consistent
- It is presented well
- Contains facts which are relevant to our requirement

Bad Data

- Data is scattered
- Contains a lot of incorrect values
- Contains missing and duplicate values
- It is poorly presented
- Contains facts which are not relevant to our requirement

Data Acquisition from Websites

The process of collecting data from websites using software is called **Data Scraping**. It is a common method for extracting information from websites. It is commonly known as Web Scraping.

Just like you might copy text from a book or from your friend, data scraping involves copying information from websites. But instead of doing it manually, we use special tools or programs to do it automatically. These tools can navigate websites, find the information we want, and copy it into the required format.

We scrape websites to get data needed for different reasons. It can be collecting prices for market research, news articles for analysis, or customer reviews for a product.

While web scraping is not illegal, using data without permission is illegal. Think of web scraping like picking fruit from someone else's garden without their permission and it is also about what you do with the fruit afterwards

Using data with permission is legal and ethical, just like getting permission from the owner of garden to take fruit. It's all about respecting the rights of the website owner and following the rules.

Ethical Concerns in Data Acquisition

While gathering data and choosing datasets, certain ethical issues can be addressed before they occur:

Bias	Take steps to understand and avoid any preferences or partiality in data
Consent	Take necessary permissions before collecting or using an individual's data
Transparency	Explain how you intend to use the collected data and do not hide intentions
Anonymity	Protect the identity of the person who is the source of data
Accountability	Take responsibility for your actions in case of misuse of data

Usability, Features, and Preprocessing of Data

Data is indeed a collection of information gathered through various means such as observations, measurements, research, surveys or analysis. This information can include a wide range of elements like facts, numbers, names, figures, or descriptions of things. To make data easier to understand and analyse, it is often organised into formats such as graphs, charts, or tables.

Usability of Data

Let's take an example of completing a school project. You need clear instructions, a neat workspace, and accurate information. Similarly, using data effectively relies on its clarity, organisation, and accuracy. There are three primary factors determining the usability of data:

1. **Structure of Data:** Defines how data is stored. Data needs to have a clear structure. It should be organised in a way that makes sense so that it can be used effectively.

   Like when your mother starts cooking your favourite food she ensures before cooking that all ingredients are available and are put in order for smooth and organised cooking. For example,

   Marks of a students arranged in a spreadsheet.

Student ID	Class	Section	Name	Percentage
10187	12	D	Rohit Rawat	72%
10013	12	B	Ashish Gupta	85%
10143	12	C	Vishal Garg	65%
11919	11	E	Chandan Bhatia	89%
10578	12	C	Ruchi Sharma	91%
10143	12	C	Vishal Garg	65%
11518	11	B	Deepak Vashisht	81%
11213	11	A	Deepti Verma	95%
10311	10	C	Vashali Gurung	93%
11095	11	A	Misha Malhotra	83%

Spreadsheet – Good structure
Data is stored in a sheet with the details of each individual stored according to a set of rules.

Rohit Rawat a student with ID 10187 of Class 12 Section D has scored 72%.

Text document – Poor structure
Data is stored in a text document with no set of organising rules.

2. **Cleanliness:** Clean data should not have duplicates, missing values, outliers, and other anomalies so that its reliability and usefulness for analysis is not affected. In the given example, cleaning of data removes the duplicate values.

Student ID	Class	Section	Name	Percentage
10187	12	D	Rohit Rawat	72%
10013	12	B	Ashish Gupta	85%
10143	12	C	Vishal Garg	65%
11919	11	E	Chandan Bhatia	89%
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10013	12	B	Ashish Gupta	85%
10578	12	C	Ruchi Sharma	91%
10143	12	C	Vishal Garg	65%
10187	12	D	Rohit Rawat	72%

3. **Accuracy:** Accuracy is same as reliability so it indicates how well the data matches real-world values. Accurate data closely reflects actual values without errors, enhancing the quality and trustworthiness of the dataset. When your measurement is accurate, it makes your data really good. It's like having a gold star on your homework—it shows you did a great job!

In the example given below, we are comparing data gathered for measuring the weight of 12 eggs in a box in grams.

Weight of 12 Eggs in a Box (gms)	Average
1116	
840	
1080	720
1200	
720	
Inaccurate Data	**Average**

Weight of 12 Eggs in a Box (gms)	Average
600	
840	
660	720
780	
720	
Accurate Data	**Average**

Ai Task

#Creativity & Innovativeness

Open a website https://www.kaggle.com. Kaggle is like a playground for data enthusiasts! It's an online platform where people from all over the world come together to play with data, learn new things, and compete in data science competitions.

Do this

The Titanic competition on Kaggle is a classic and beginner-friendly challenge that introduces you to the basics of data analysis and machine learning. The goal is to predict whether a passenger survived the Titanic shipwreck based on factors like age, gender, ticket class, and more.

Explore:

Kaggle provides tutorials and notebooks to help you get started with the Titanic competition. You can find them under the "Notebooks" tab on the competition page.

Features of Data

Data features are also called the characteristics or properties of the data. They describe each piece of information in a dataset. They define what each data point represents and help us make sense of the data. For example,

- In a table of student records, features could include things like the student's name, age, or grade.
- In a photo dataset, features might include properties like the colour present in each image, the resolution, brightness, or the presence of certain objects.

These features help us understand and analyse the data. In AI models, we need two types of features: Independent and Dependent.

Independent

Independent variables (sometimes called predictor variables) are those that are used to generate predictions about or to account for the variation in the dependent variable (the goal). These features are the input to the model—they're the information we provide to make predictions.

Dependent

The dependent variable is the variable about which predictions or explanations are being sought. These features are the outputs or results of the model—they're what we're trying to predict. For example, imagine we're building an AI model to predict students' final exam grades based on various factors.

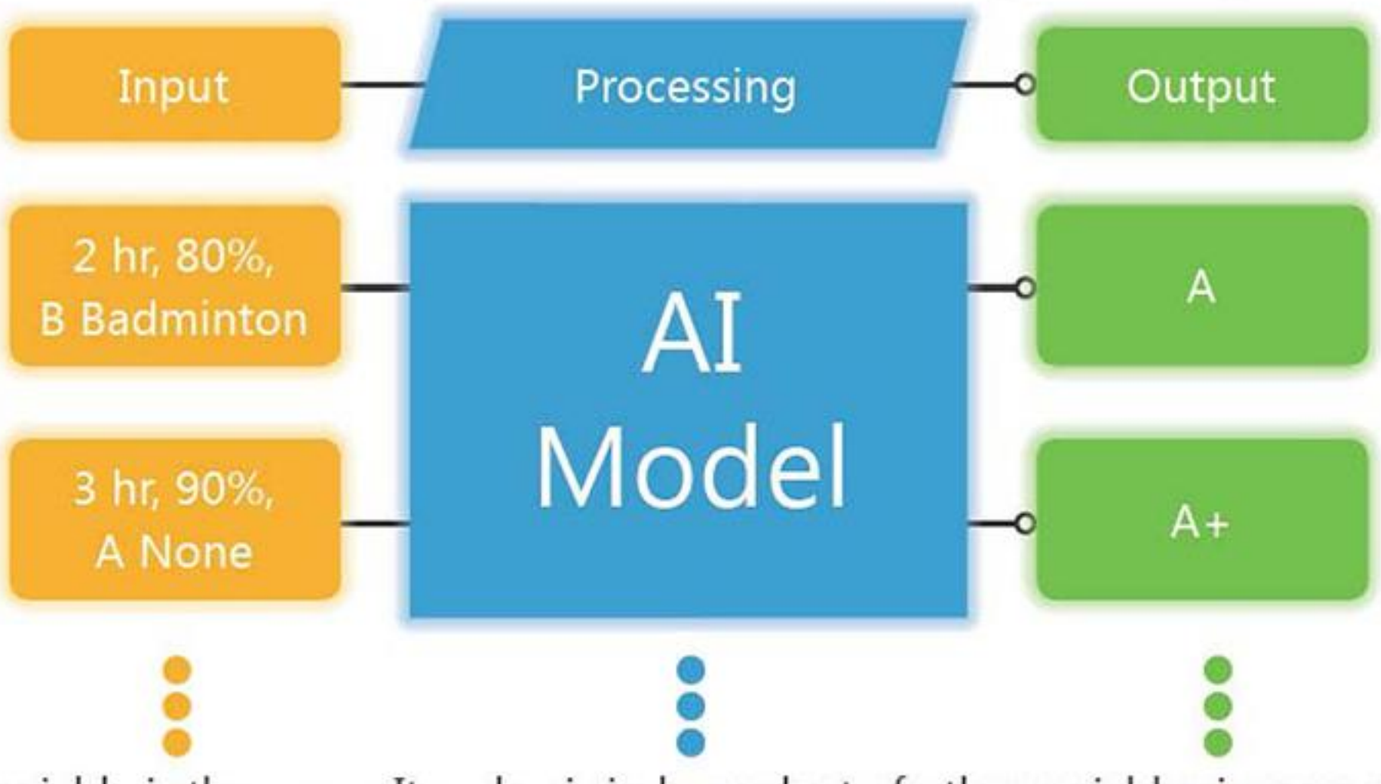
The independent features would include:

- **Study hours:** The number of hours a student spends studying.
- **Attendance:** Whether the student attended classes regularly or not.
- **Previous grades:** The grades the student received in previous exams.
- **Extracurricular activities:** Participation in extracurricular activities, such as sports or clubs.

The dependent feature, in this case, would be:

- The final exam grade—the outcome or prediction that the model gives us.

Together, they help us understand and improve student outcomes using AI-driven predictions.



- The independent variable is the cause. Its value is independent of other variables in your study.
- The dependent variable is the effect. Its value depends on changes in the independent variable.

Data Preprocessing

Data preprocessing is an essential phase in the machine learning process that prepares datasets for effective machine learning applications. It is the process of detecting and correcting (or removing) corrupt or inaccurate records from a dataset. It includes multiple processes to clean, transform, reduce, integrate, and normalise data.

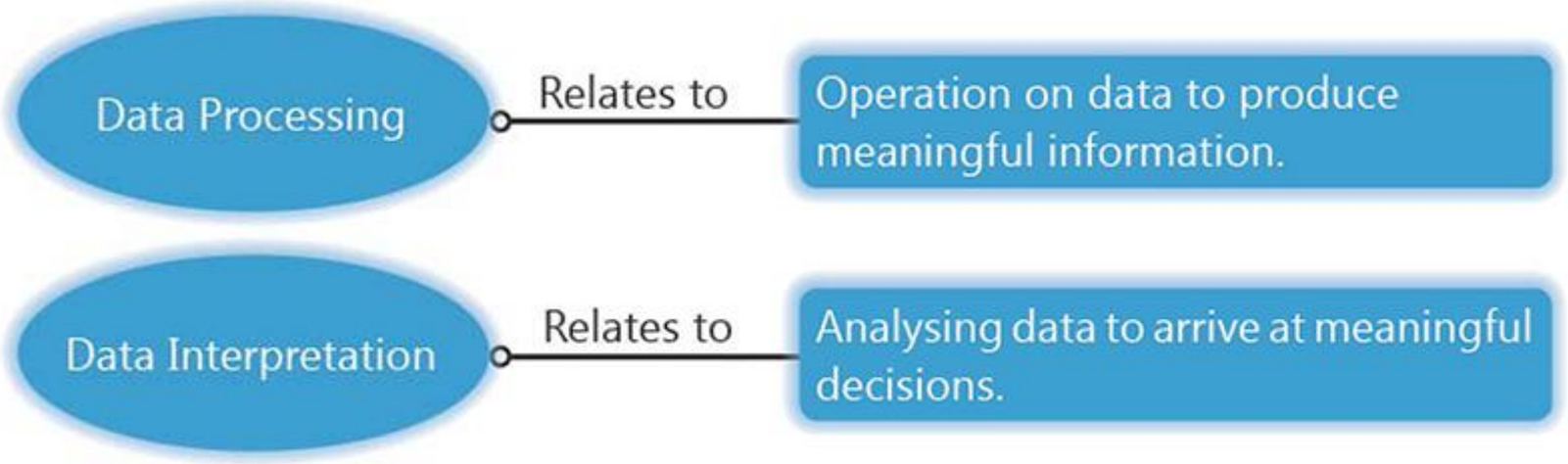
Data Processing and Data Interpretation

Data processing means preparing and analysing raw information to train models or predict outcomes, including tasks like cleaning and training. **Data interpretation** in AI involves analysing model outputs to understand patterns, refine models, and make informed decisions.

Observe and answer the following:

- How many big lollipops are there in the given picture?
- If each large lollipop represents 5 units of sweetness, how much total sweetness do the three lollipops represent?
- Among the small round candies, which colour appears most frequently?
- What is the ratio of pink round candies to blue round candies?

- How many pink round candies are there in the image?



Data Processing

Data processing involves tasks to refine raw data for analysis or application, including cleaning, organising, transforming, and summarising information. It ensures data accuracy, relevance, and accessibility for effective decision-making and analysis. It is crucial across various sectors like business, science, and technology, facilitating better utilisation of data assets. Data processing helps computers understand raw data. Use of computers to perform different operations on data is included under data processing.

Data Interpretation

Data interpretation is the process of making sense of data by analysing it to uncover patterns, trends, and insights. It involves examining the data to understand its meaning, implications, and significance, helping to inform decision-making and draw conclusions. It is the process of making sense out of data that has been processed. The interpretation of data helps us answer critical questions.

Process of Data Interpretation

The steps in the process of data interpretation are as follows:

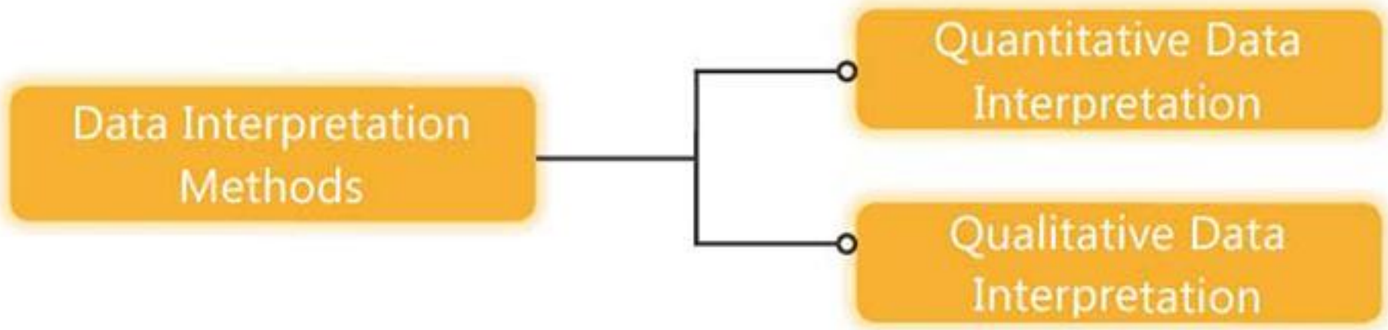
1. **Acquire:** This initial step involves gathering raw data from diverse sources such as surveys, databases, or sensors. It ensures that all relevant information is collected to provide a comprehensive dataset for analysis.
2. **Process:** Once the data is collected, it undergoes cleaning and organisation to remove errors, inconsistencies, or irrelevant information. This step ensures that the data is in a standardised format and ready for further analysis.
3. **Analyse:** In this phase, the cleaned and organised data is scrutinised to identify patterns, correlations, or trends. Statistical methods, algorithms, or data visualisation techniques may be employed to extract meaningful insights from the data.
4. **Interpret:** After analysing the data, the results are interpreted to derive actionable insights or conclusions. This involves understanding the implications of the analysis findings in the context of the problem or question at hand.
5. **Present:** The final step involves presenting the interpreted findings in a clear and engaging manner. This could include visualisations such as tables, graphs or charts, along with concise summaries, to effectively communicate the insights derived from the data analysis.

These steps make sure that working with data is organised, complete, and useful, so that organisations can make smart choices based on the data.

Methods of Data Interpretation

Data interpretation is the process of making sense out of a collection of data that has been processed. This collection may be present in various forms like bar graphs, line charts and tabular forms and other similar forms.

There are two ways to interpret data-



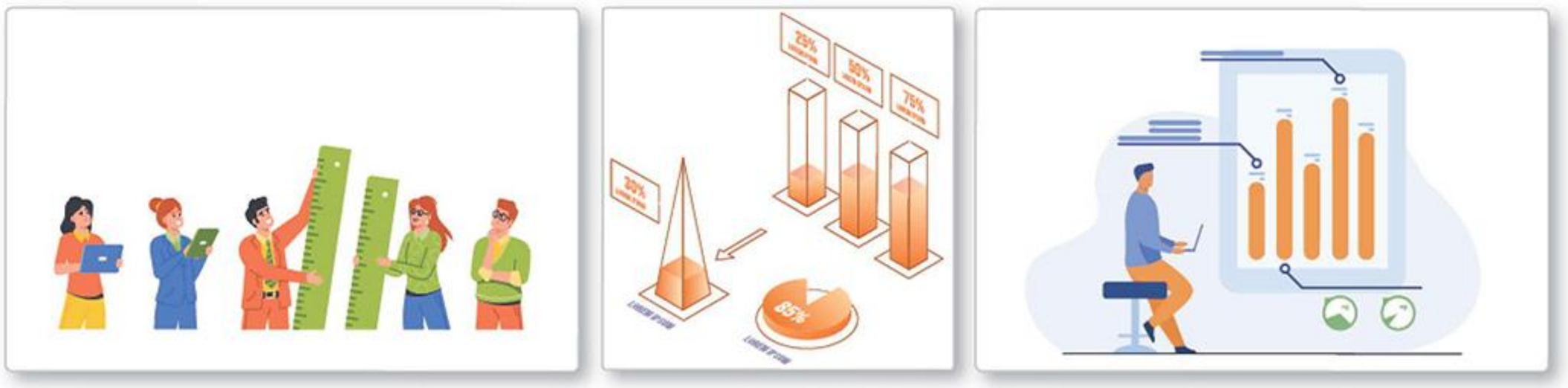
Quantitative Data Interpretation

It is the process of analysing and understanding quantitative or numeric data. This type of data often comes from surveys, experiments, and numerical measurements. Quantitative data provides statistical insights and helps in identifying patterns and trends. It requires statistical methods and techniques like mean, median, standard deviation, etc. to interpret the data. The interpretation of quantitative data focuses on measurable outcomes and numerical relationships. It helps us answer questions like "when," "how many," and "how often".

For example, (how many) numbers of likes on the Instagram post.

Data Collection Methods in Quantitative Data Interpretation

Data collection methods in quantitative data interpretation involve systematic techniques like surveys and experiments to gather numerical data. These approaches ensure data accuracy, facilitating reliable analysis and inference across various fields such as social sciences and healthcare.



Following are some application areas of quantitative data interpretation:

- **Interviews:** Quantitative interviews play a key role in collecting information.
- **Polls:** A poll is a type of survey that asks simple questions to respondents. Polls are usually limited to one question.
- **Observations:** Quantitative data can be collected through observations in a particular time period.
- **Longitudinal studies:** A type of study conducted over a long time.
- **Survey:** Surveys can be conducted for a large number of people to collect quantitative data.

Steps to Quantitative Data Analysis

The four steps involved in quantitative data analysis are:

1. **Relate measurement scales with variables:** Understand the type of data you have and match it with the appropriate measurement scale. For example, if you are looking at student grades, use ordinal (A, B, C) or ratio (numeric scores) scales.
2. **Connect descriptive statistics with data:** Use statistical measures to summarise and describe your data.

   For example, if you have test scores for a class of students, calculate the mean score to know the average performance, the median to understand the central tendency, and the standard deviation to see how varied scores are.
3. **Decide a measurement scale:** Choose the appropriate scale to measure your data based on the type of variable and the level of detail required. For example, if you are measuring weight, use a ratio scale because weight can be zero and can be measured precisely.
4. **Represent data in an appropriate format:** Display your data in a way that makes it easy to understand and interpret. For example, if you want to show the distribution of test scores in a class, you might use a histogram. If you want to show the relationship between study hours and test scores, a scatter plot would be appropriate.

Qualitative Data Interpretation

It is the process of analysing and understanding non-numeric data. This type of data is unstructured and often comes from interviews, surveys, observations, or textual content. Qualitative data tells us about the emotions and feelings of people. Qualitative data interpretation is focused on insights and motivations of people.

Data Collection Methods in Qualitative Data Interpretation

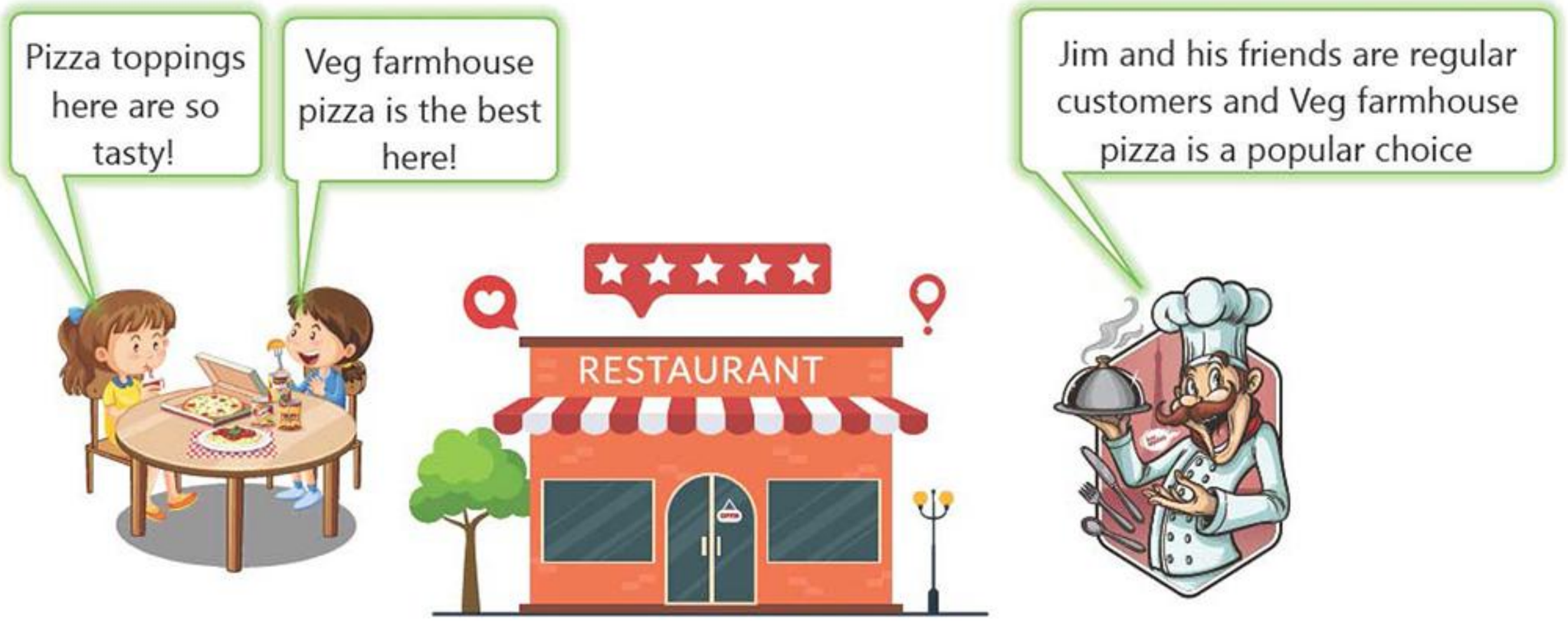
Data collection methods in qualitative data interpretation involve techniques such as interviews and observations to gather rich, descriptive data for detailed analysis, fostering a deeper understanding of complex human experiences and behaviours. Some methods are as follows:

- **Record keeping:** This method utilises documents that are reliable and well curated and other similar sources of information as the data source that are verified and maintained. It is similar to going to a library.
- **Observation:** In this method, data is collected by observing the participants, their behaviour and emotions, carefully.
- **Case studies:** In this method, data is collected from case studies.
- **Focus groups:** In this method, data is collected after a group discussion on topics of relevance.
- **Longitudinal studies:** In this data collection method, data is collected on the same data source repeatedly over an extended period of time.
- **One-to-one interviews**: In this method, data is collected using a one-to-one interview.

Open Ended Surveys and Questionnaires

Open ended surveys and questionnaires allow organisations to collect views and opinions from respondents without meeting in person.

Reviews by customers – Qualitative data



Ai Task

#Problem Solving & Logical Reasoning

Let's do a small activity based on identifying trends.

- Visit the link: https://trends.google.com/trends/?geo=IN (Google Trends)
- Explore the website
- Check what is trending in the year 2024 – Global
  - * Make a list of trending sports (top 5)
  - * Make a list of trending movies (top 5)

List of trending sports (top 5)	List of trending movies (top 5)

Steps to Qualitative Data Analysis

The five steps involved in qualitative data analysis are:

1. **Collect data:** Gather qualitative data through various methods to understand people's experiences, opinions, or behaviours. This is done through interviews, surveys, observations, or documents. For example, a researcher interviews patients about their experiences with a new healthcare app, recording their responses for further analysis.
2. **Organise and connect the qualitative data:** Prepare and arrange the collected data in a systematic way to make it easier to work with. For example, the researcher transcribes the recorded interviews into text documents and organises them by participant or interview date.

3. **Set a code to the data collected:** Assign labels or codes to different parts of the data to identify themes, patterns, or categories. For example, the researcher reads through the interview transcripts and highlights sections discussing "ease of use," "technical issues," and "benefits of the app," tagging them with corresponding codes.
4. **Analyse your data for insights:** Examine the coded data to identify deeper patterns, relationships, and insights. For example, The researcher groups codes related to "ease of use" and "technical issues" into a broader theme of "user experience" and analyses how these themes impact overall user satisfaction with the app.
5. **Reporting on insights derived from analysis:** Present the findings clearly, using quotes and visual aids to support your conclusions and recommendations. For example, the researcher writes a report highlighting the main themes along with positive and negative feedback.

Difference Between Qualitative and Quantitative Data Interpretation

Qualitative Data Interpretation	Quantitative Data Interpretation
Categorical	Numerical
Provides insights into feelings and emotions	Provides insights into quantity
Answers how and why	Answers when, how many, or how often
Methods – Interviews, Focus Groups	Methods – Assessment, Tests, Polls, Surveys
Example question – Why do students like attending online classes?	Example question – How many students like attending online classes?

#Coding & Computational Thinking

Word Puzzle

Instructions:

- Partner with a person to play the game.
- There will be three rounds of Word puzzle.
- Play 3 rounds.

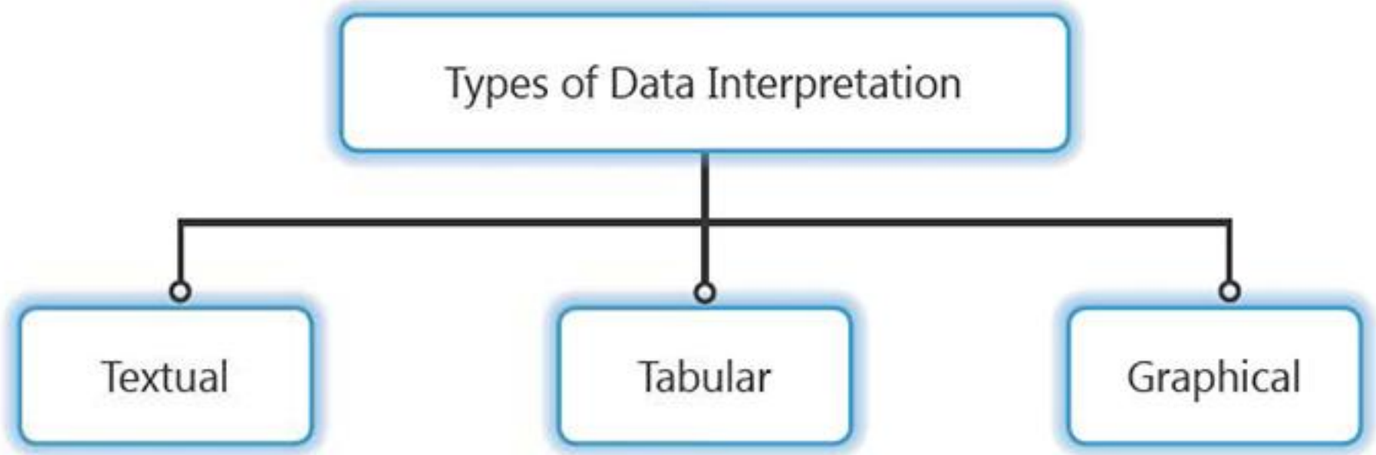
Now answer the following questions:

- Who won round one?
- Who won round two?
- Who won round three?

If you answered any of the above questions, you collected data!

Types of Data Interpretation

There are three ways in which data can be presented:



Textual DI

Data is put into words, like in a paragraph, which works well for small amounts of data that can be easily understood. But for larger amounts, this type of presentation may not be the best because it can get too complicated. For instance, a paragraph might describe how a company's sales went up in the first quarter, and how many units of each product they sold, as well as improvements in customer satisfaction.

Tabular DI

Data is organised systematically in rows and columns within a table, facilitating structured representation. In the example given below, the title of the table, "Students, Marks Analysis," provides a descriptive overview of the table's content, summarising the analysis of student marks within the table.

Table Students' Marks Analysis

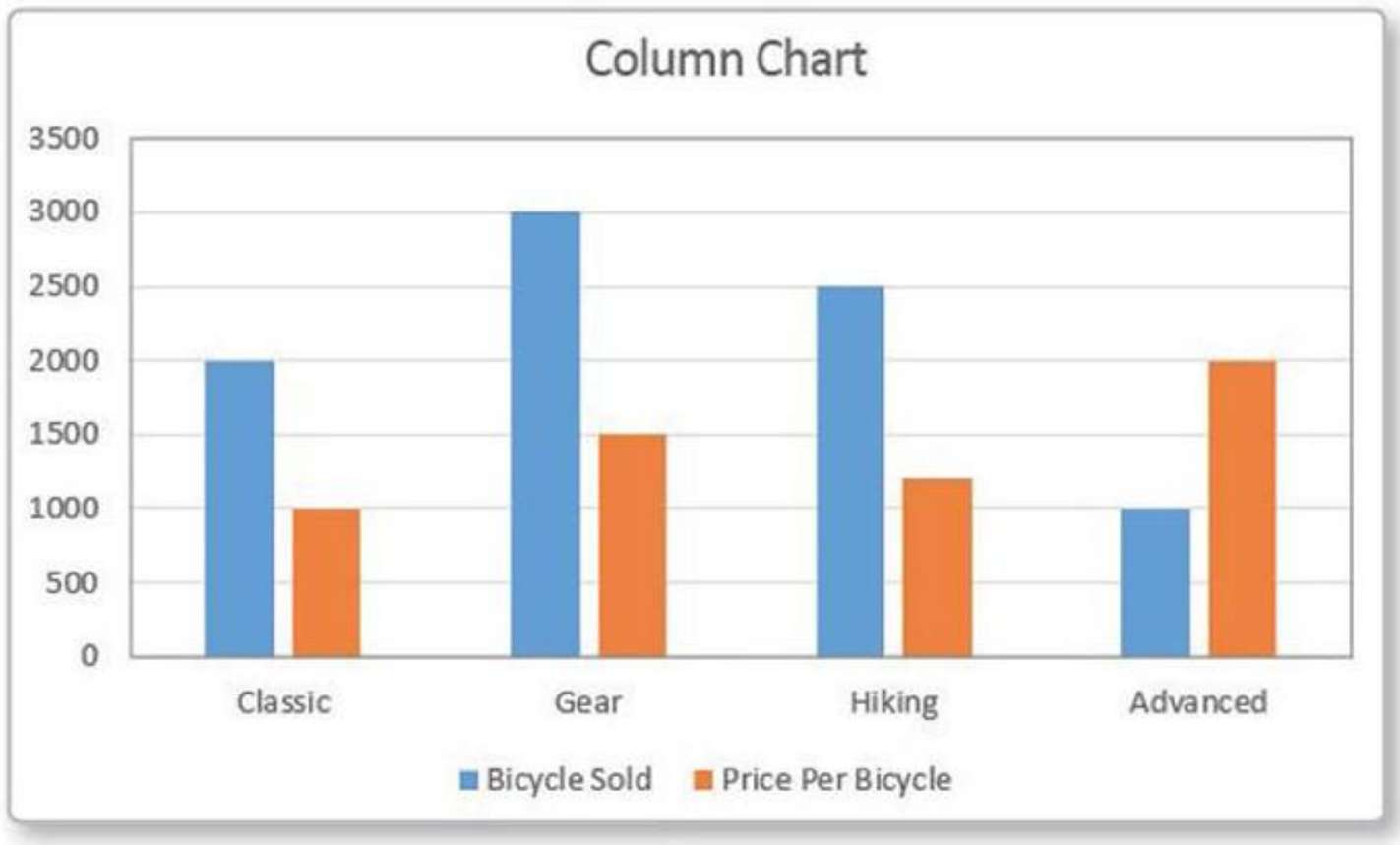
Student Name	English	Maths	Science	Percentage
Rehan	85	90	88	87.67%
Hemant	78	82	80	80.00%
Deepak	92	88	91	90.33%
Lucky	74	76	78	76.00%
Ramesh	88	84	85	85.67%
Saima	90	89	92	90.33%
Abdul	80	78	79	79.00%
Seema	85	87	86	86.00%

Graphical DI

Some of the graphs include bar graphs, line graphs, pie charts, and scatter plots, which help in visualising trends, relationships, and distributions within the data.

Bar Graphs

In a Bar Graph, data is represented using vertical and horizontal bars.



Pie Charts

Pie charts resemble pies, with each slice representing a portion of the whole pie assigned to different categories. These circular charts are divided into sections, and the size of each section corresponds proportionally to its value within the dataset.

Line Graphs

A line graph connects data points to illustrate changes in quantity over time, aiding in visualising trends and patterns.

Ai Reboot

Quiz Time: AI Quiz

In a class of 40 Students [Pair Activity]

Materials Required:

ITEMS	QUANTITY
COMPUTERS	20

Brief:

The following are questions for the quiz. You can either go for a Pen/Paper Quiz or you can visit any open-sourced, free, online portal; one of which is Kahoot, and create your quiz there. For Kahoot: Go to https://kahoot.com/ and create your login ID. Then, add your own kahoot in it simply by adding all the given questions into it. Once created, you can initiate the quiz from your ID and students can participate in it by putting in the Game pin.

Quiz Questions

1. What are the basic building blocks of qualitative data?
   a. Individuals b. Units c. Categories d. Measurements
2. Which among these is not a type of data interpretation?
   a. Textual b. Tabular c. Graphical d. Raw data
3. Quantitative data is numerical in nature.
   a. True b. False
4. A bar graph is an example of ..... data interpretation.
   a. Textual b. Tabular c. Graphical d. None of these
5. ..... relates to the manipulation of data to produce meaningful insights.
   a. Data processing b. Data interpretation
   c. Data analysis d. Data presentation

Importance of Data Interpretation

Data interpretation is crucial as it transforms raw data into actionable insights, guiding informed decision-making. By analysing and understanding data, organisations can uncover trends, patterns, and relationships, enabling them to optimise strategies, mitigate risks, and drive growth.

Informed Decision Making

A decision is only as good as the knowledge it is based on. It means when we analyse data, we get a clear picture of what's going on. This helps us make decisions that are more likely to lead to success.

For example, if the average height of students is known, the school can custom design the chairs and tables according to the requirements of the class.

Reduced Cost

Identifying needs can lead to a reduction in cost. It means by knowing what's necessary, we can cut down on waste. We can use resources more efficiently and not spend money on things that aren't important.

For example, restaurant owner could decide to drop/modify some dishes of the menu which aren't popular or have bad reviews.

Identifying Needs

We can identify the needs of people by data interpretation. It means understanding what people want or require by looking at the information we have.

For example, in a Pizza Shop, there are possibilities that Veg Farmhouse Pizza is a popular choice among the age group 8-10 years old.

Using Tableau for Data Presentation

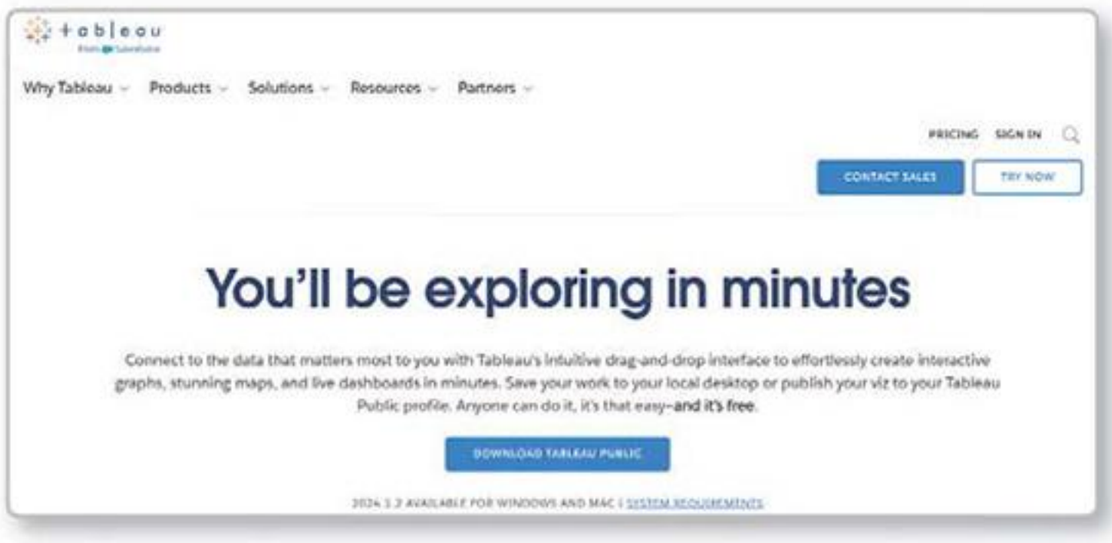
Using Tableau for data presentation involves connecting to various data sources, creating diverse visualisations, and enabling interactive features. It supports sharing and collaboration, offers advanced analytics capabilities, and promotes best practices for clear and effective data communication.

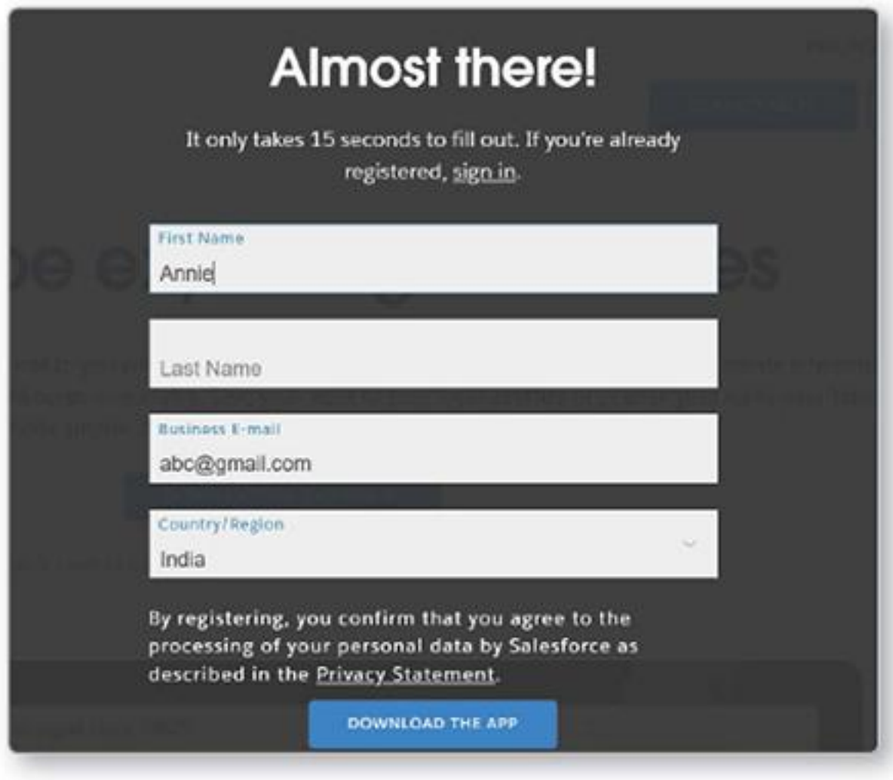
What is Tableau?

Tableau is a powerful data visualisation and business intelligence tool for visualising and analysing data in order to aid in business choices. It takes in data and produces various charts, graphs, maps, dashboards, and stories.

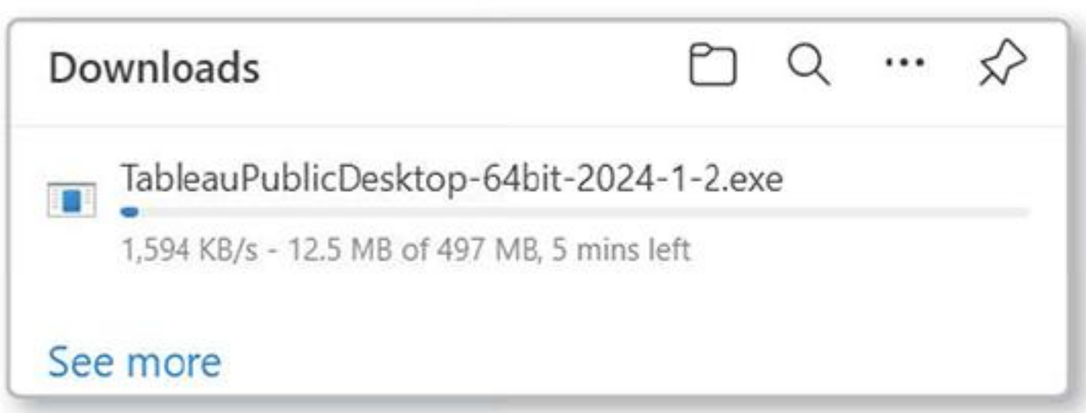
Steps to Download Tableau

1. Visit the link https://public.tableau.com/en-us/s/download
2. Click on the **DOWNLOAD TABLEAU PUBLIC BUTTON.** It will display the given screen where you enter your details.



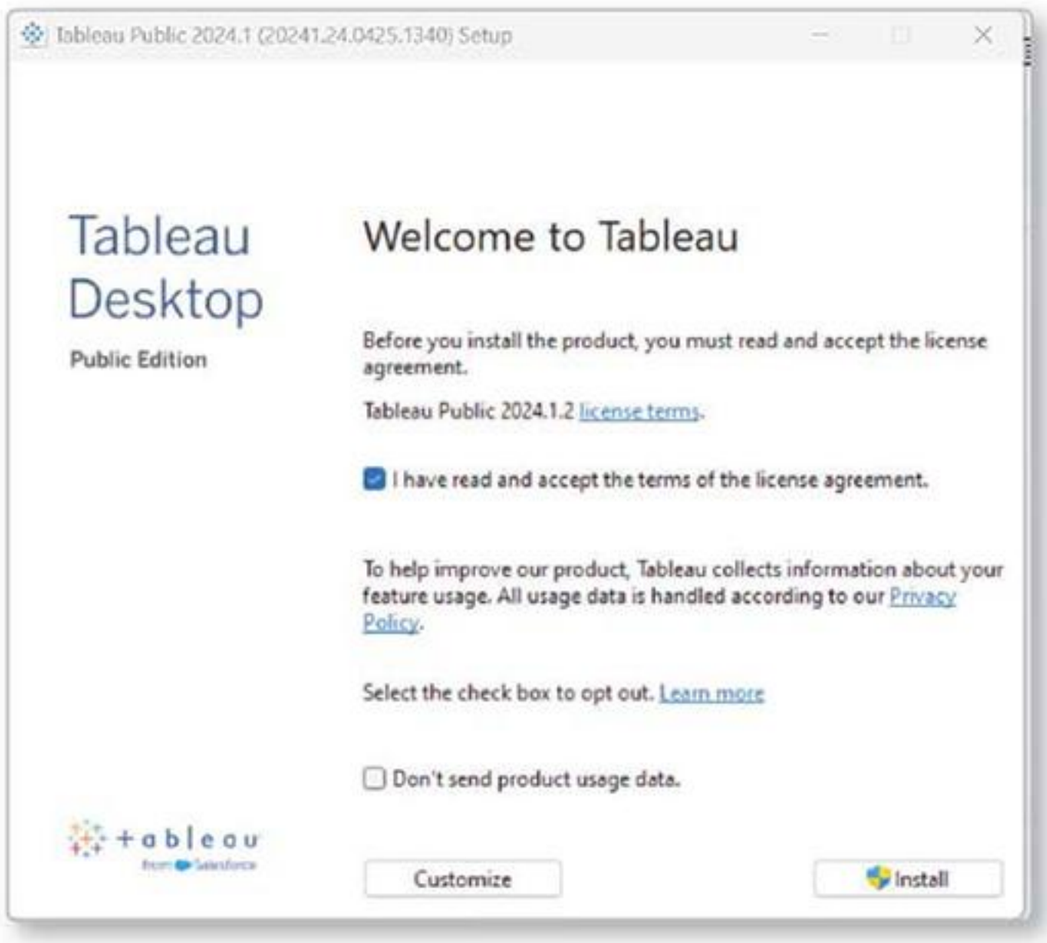


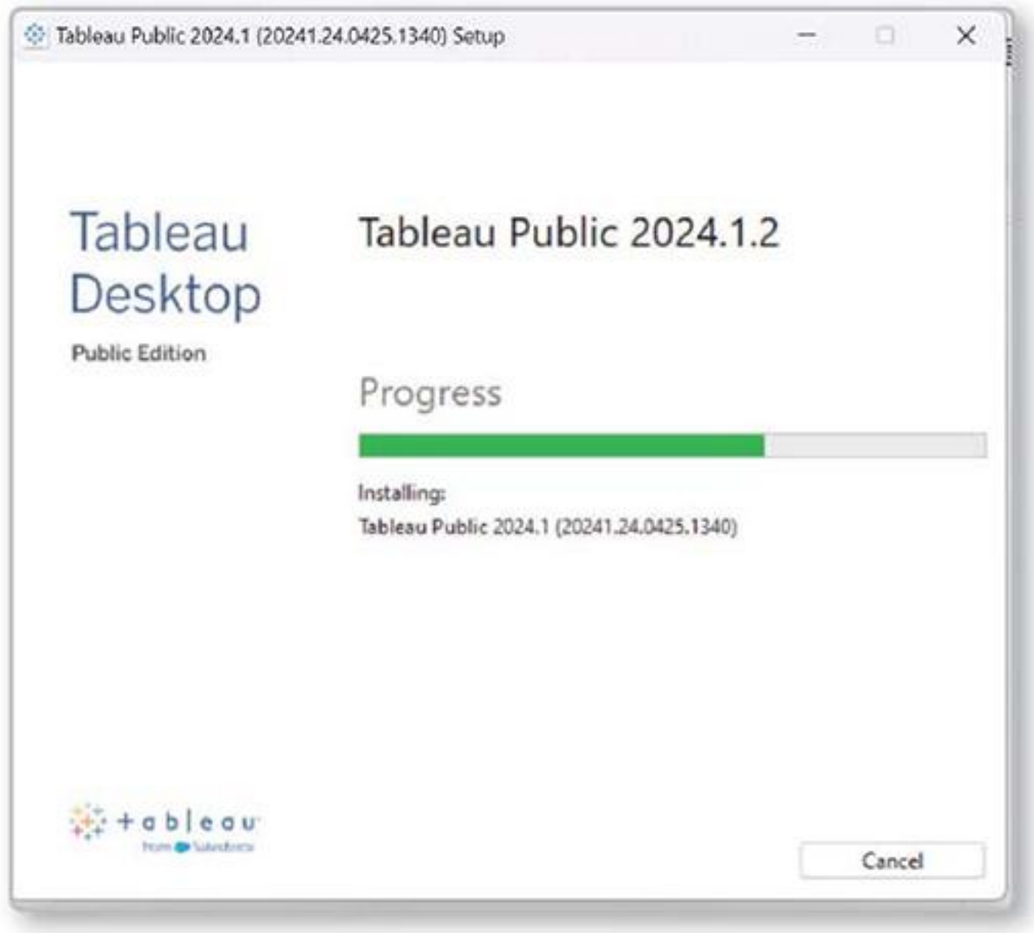
3. Click on the **DOWNLOAD THE APP** button to begin with the download process as shown below:



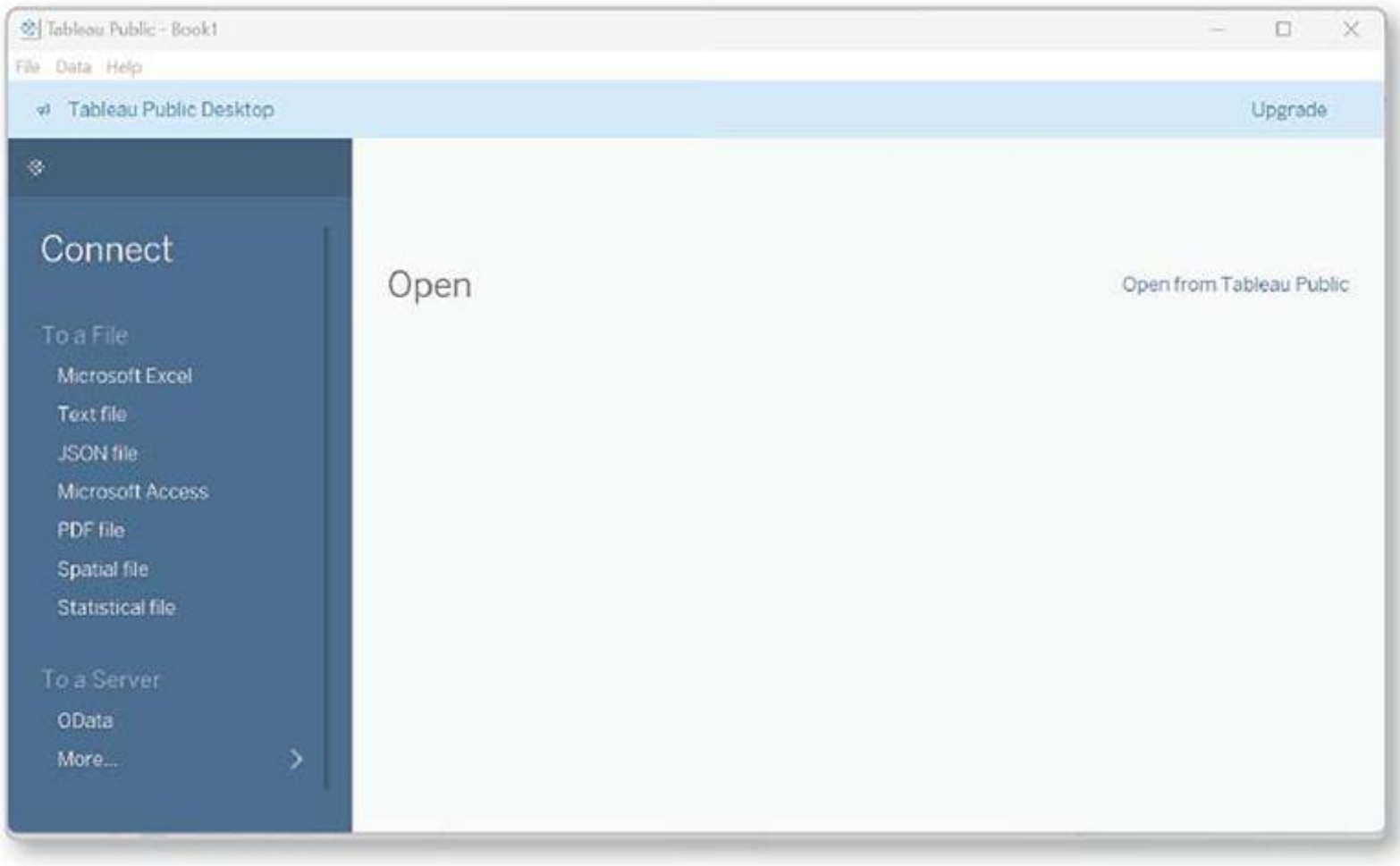
4. After finishing with the downloading of the files, double-click the installer of the **Tableau Public Desktop**. The **Tableau Public 2024.1 Setup** wizard opens.

5. Select the **I have read and accept the terms of the license agreement** check box to accept the terms of the license agreement.
6. Click on the **Install** button. Process of installation begins as shown below:





As soon as the installation process is over the application is ready for use.



You can also open the Tableau application by double-clicking the shortcut icon of the Tableau application on the Desktop.

Creating a Bar Graph Using Tableau

The steps to draw a Bar Chart in Tableau are as follows:

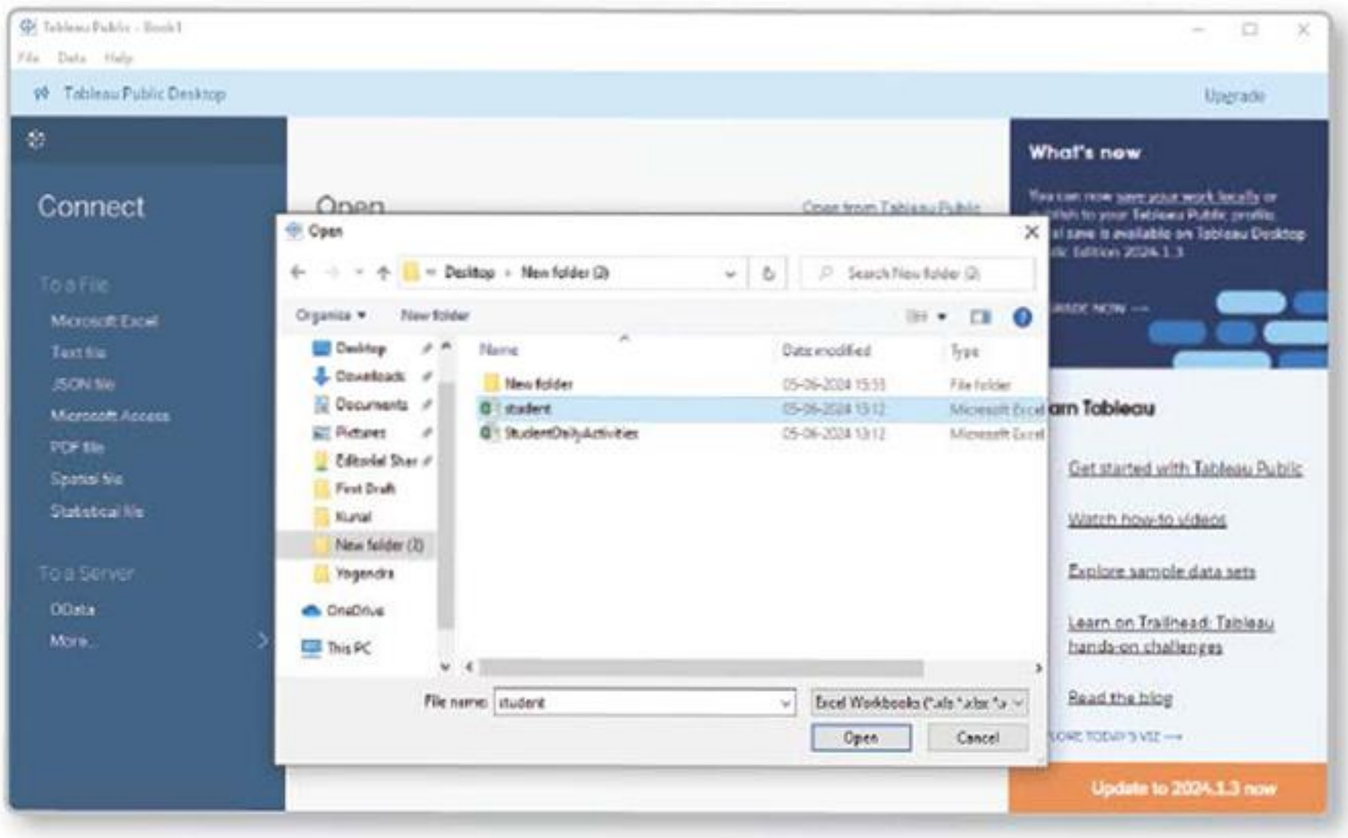
1. Create an Excel file and save it as **student.xlsx** with the following data:

	A	B	C	D	E
1	**Student**	**Subject**	**Score**		
2	Aarav	Math	85		
3	Aarav	Science	90		
4	Aarav	English	88		
5	Priya	Math	78		
6	Priya	Science	82		
7	Priya	English	80		
8	Rahul	Math	92		
9	Rahul	Science	85		
10	Rahul	English	87		
11	Sanya	Math	88		
12	Sanya	Science	91		
13	Sanya	English	89		
14					

2. Double-click on the **Tableau app** shortcut icon on the **Desktop**.

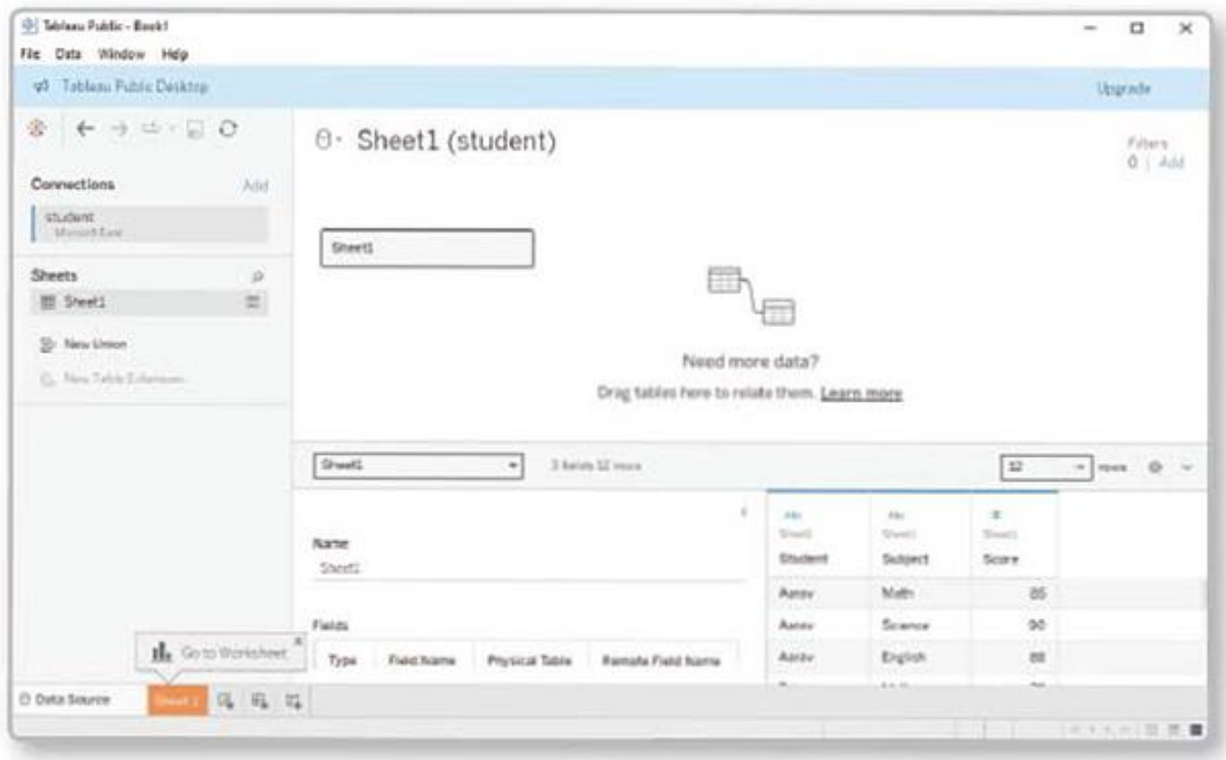
   The **Tableau** app opens.

3. Select the **Microsoft Excel** option from the **Connect** pane to access the Excel data that is used for visualising the representation in Tableau. The **Opens** dialog box appears.
4. Navigate the location where the Excel file is stored.
5. Select the **student.xlsx** file
6. Click on the **Open** button.

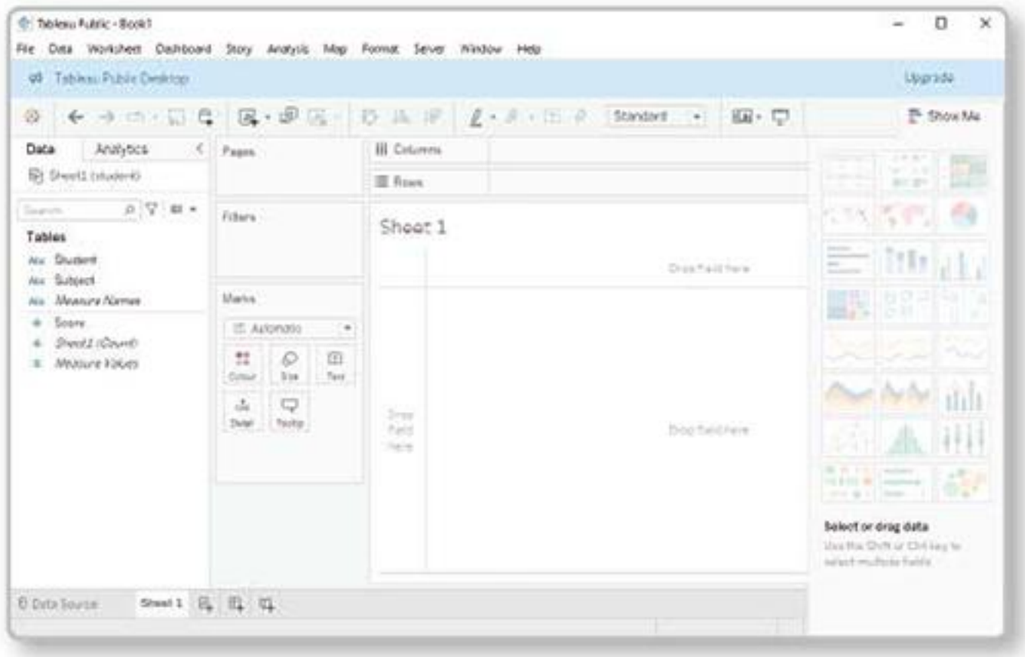


   The data of the Excel file is displayed in the **Data Source** window.

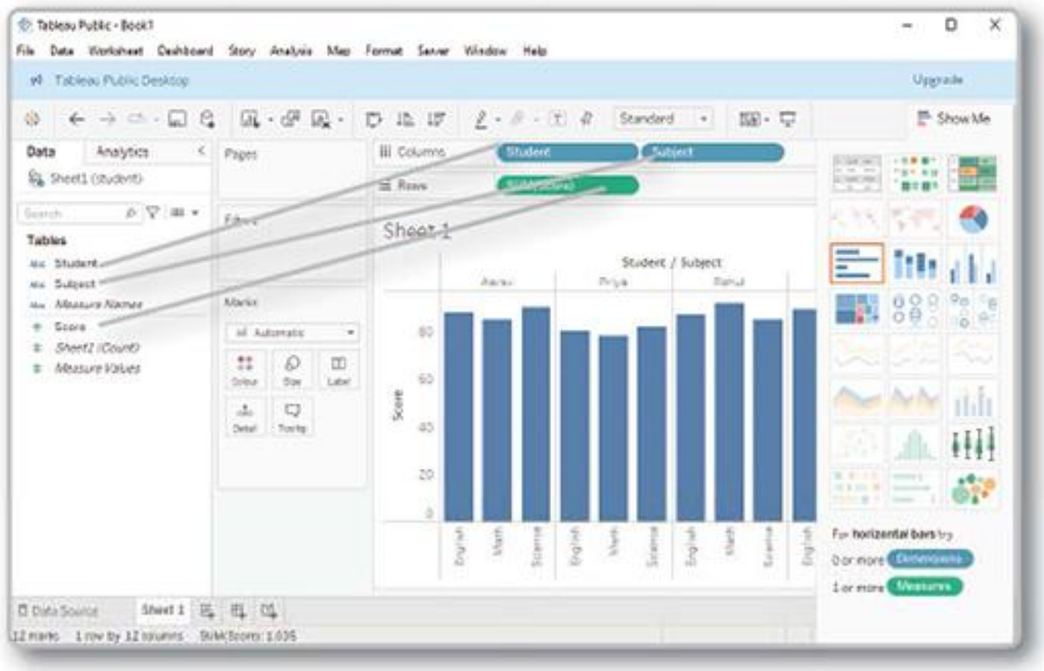
7. Click on **Sheet 1** in the **Sheet** tab.



The data of the **Sheet 1** of **student.xlsx**. In the Data pane, you will see the fields **Student**, **Subject**, and **Score**.



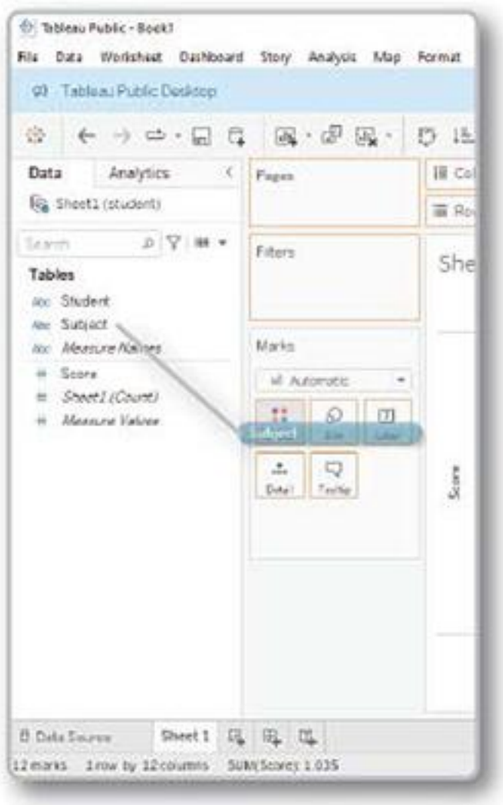
8. Drag the **Student** field to the **Columns** shelf.
9. Drag the **Score** field to the **Rows** shelf.
10. Drag the **Subject** field to the **Columns** shelf. Tableau generates a bar graph, as shown below:



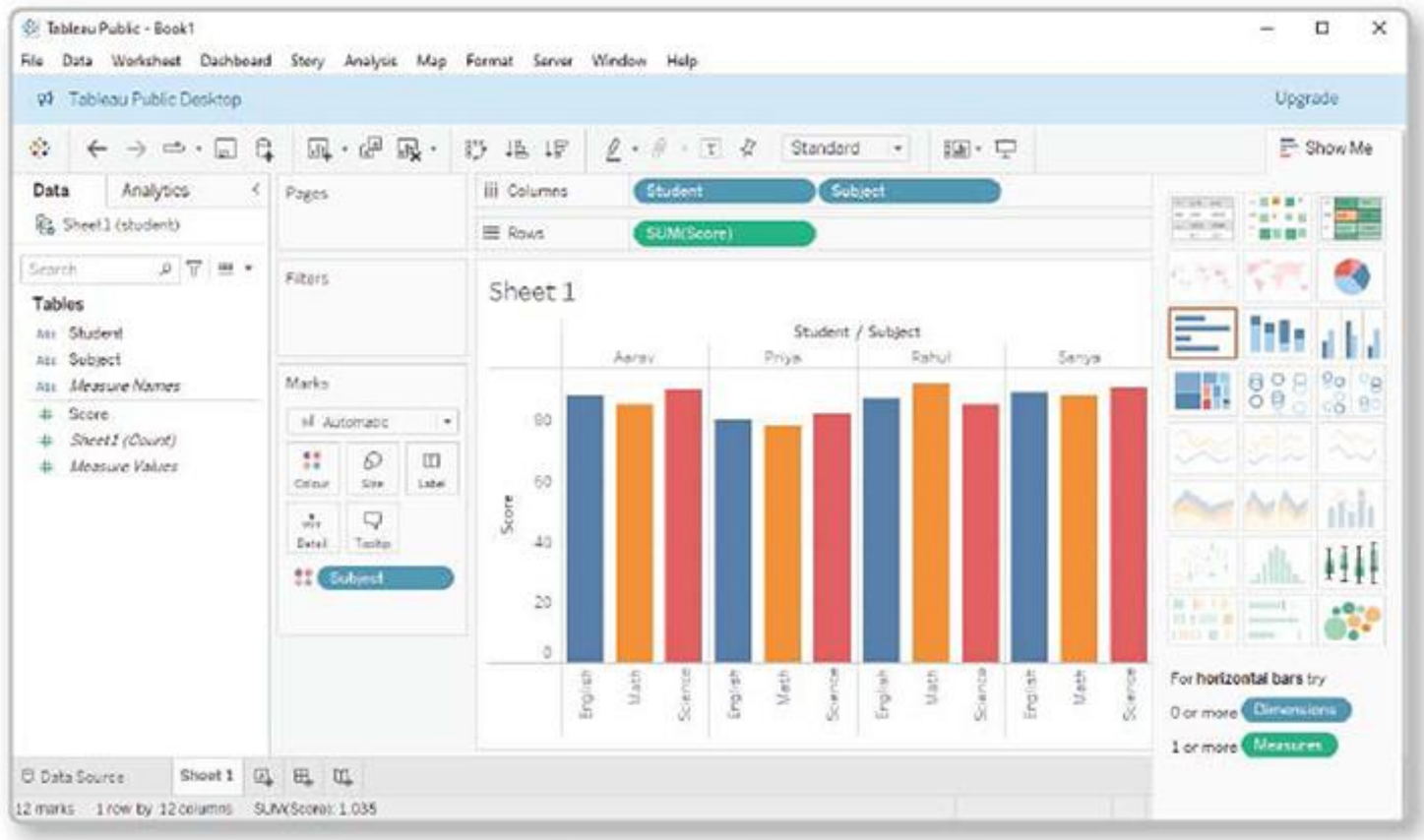
You can sort the bars in graph in ascending or descending order by clicking the **Ascending** or **Descending** option in the toolbar.

Changing Colour of the Graph

To make a colourful bar graph, drag the **Subject** field from the **Data** pane and place over the **Color** option in the **Marks** card.



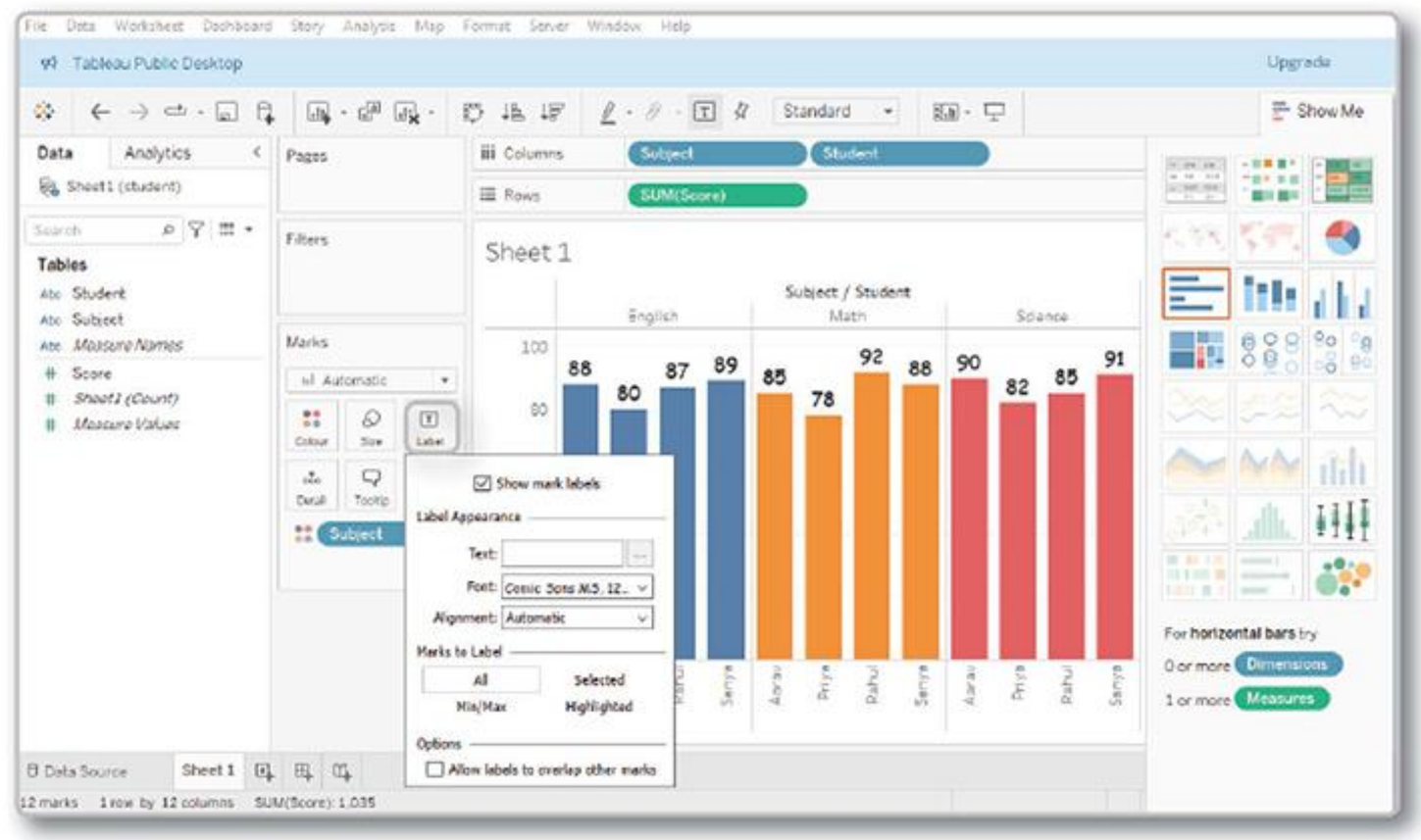
A colourful bar graph is generated, as shown below:



Changing Label of the Graph

The steps to change the label of the graph are as follows:

1. Click on the **Label** option in the **Marks** card. This opens up a box that allows us to change the font type, size, colour, etc.
2. Select the **Show mark labels** check box to show the labels on the graph.
3. Change the font type and size according to your requirement. In this case, we have changed the font size to **12** and the font to **Comic Sans MS**. The labels are displayed in the graph with the specified font type and size.

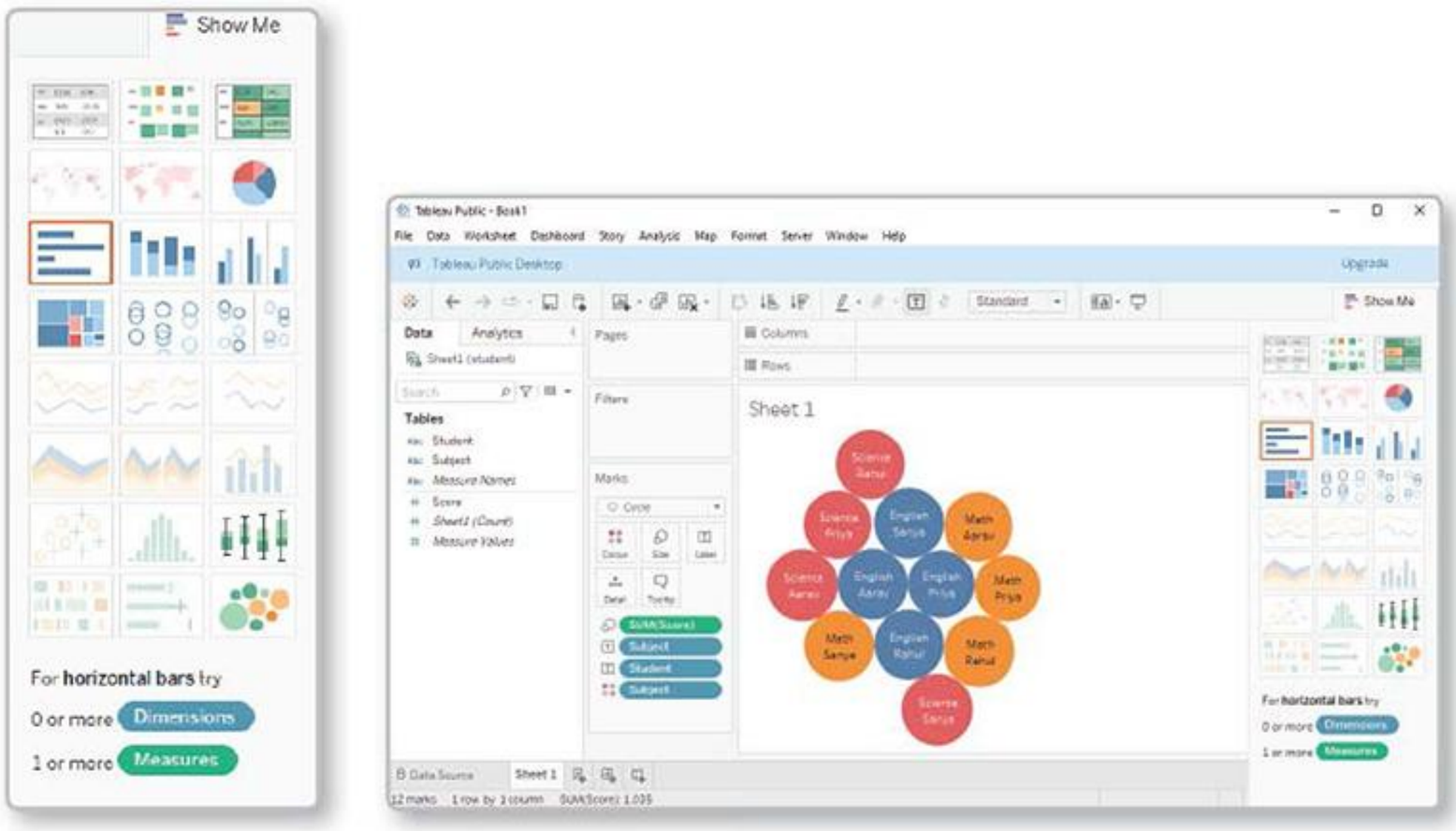


Change the Graph Type

Tableau often auto-selects the graph type based on the data. If the default graph type does not suit your data, you can change it accordingly. Perform the following steps to change the graph type:

1. Click on the **Show Me** button. The **Show Me** panel appears.

2. Select the desired graph type from the **Show Me** panel. In this case, we have selected the **Packed Bubbles** chart type. The type of the graph will be changed to **Packed Bubbles** chart type.



Duplicating a Chart

The steps to duplicate a chart are as follows:

1. Right-click the sheet in the **Sheet tab** whose chart you want to duplicate.
2. Select the **Duplicate** option from the context menu. A duplicate sheet is added in the Sheet tab.

Save and Share a Workbook

Once you have created a graph, you can save your workbook. The steps to save your Tableau Public workbook are as follows:

1. Click on the **File** → **Save** as option from the menu bar. The **Save as** dialog box opens.
2. Navigate the location where you want to save you workbook.
3. Type the name of the workbook in the **File name** text box.
4. Click on the **Save** button. The tableau public workbook is saved with the specified name.

You can export the tableau workbook as package by selecting the **Export Packaged Workbook** options in the **File** menu.

You can also share your tableau workbook by saving it to **Tableau Public** or **Tableau Server** if you have access to those services. For this, you need to select the **Save to Tableau Public** option in the **File** menu.

#Experiential Learning

Video Session

Scan the QR code or visit the following link to understand about tableau:

https://www.youtube.com/watch?v=NLCzpPRCc7U

How Ben solved his business related issue using Tableau?

Ai Task

#Problem Solving & Logical Reasoning

Your favourite songs

- Think about songs! Which songs do you like to listen to? Which songs do you love to sing?
- Do you have a favourite song, artist, album, or playlist?
- Let's start thinking about the different aspects of a song, like instruments played and lyrics.
- Do your favourite songs have anything in common?
- Maybe your favourite music falls within the same genre.
  - ✶ A genre refers to the different styles of music.
  - ✶ Common genres include hip-hop, pop, alternative, and rock.
  - ✶ Classifying songs by genre, and other traits allows us to see trends in our favourite music.
  - ✶ All of this information is valuable data that we can count, summarise, and present!

Instructions

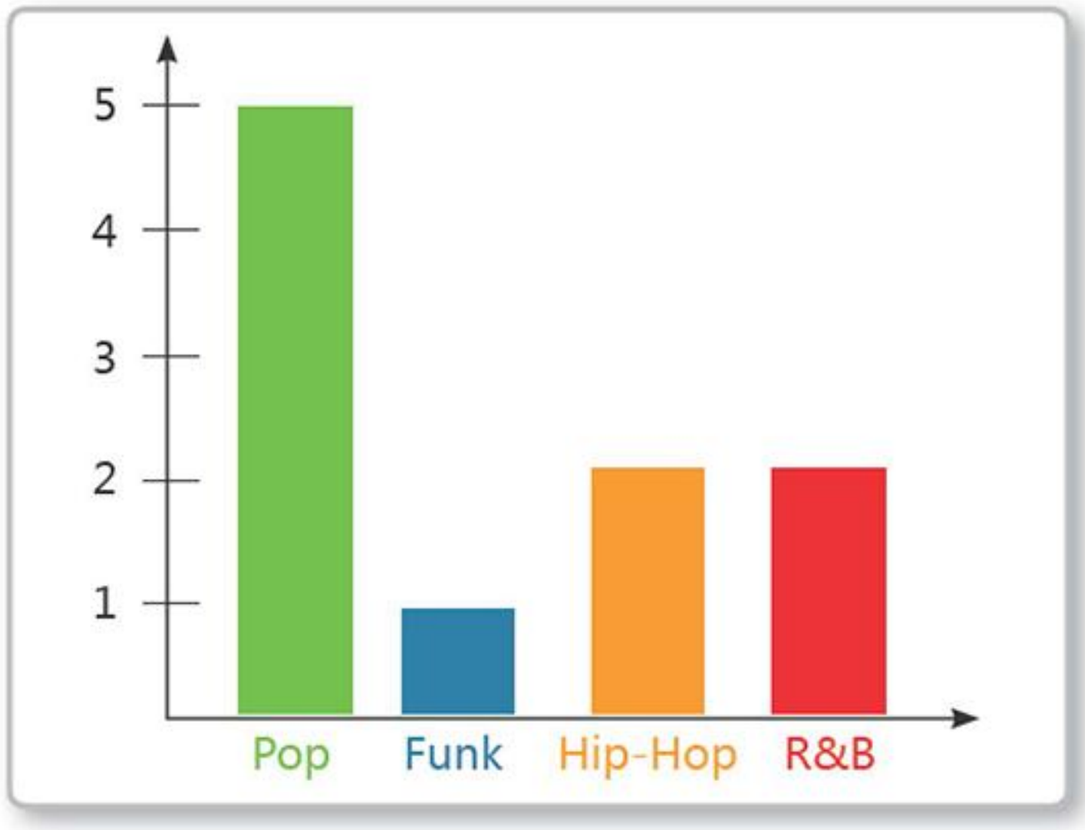
- Draw a grid with 6 columns as shown.
- Title the first column Song Name, then write down the names of 5-10 of your favourite songs.
- For this activity, we're going to collect data about the Album, Artist, Genre, Year, and Song Length.
- Add the headings to your table.
- Fill out the table by looking up each song on Google, Spotify, or Apple Music.

Song Name	Album	Artist	Genre	Year	Song Length
Blinding Lights					
Savage love					
Watermelon Sugar					
Happy					
Panini					
Cake by the Ocean					
7 Rings					
24K Magic					
Put Your Records On					
Since U Been Gone					

Let's visualise

- Count the number of songs that fall into each genre.
- Make a bar chart to visualise the number of songs within each genre using your counting. Colour each bar a different colour.
- You will get a graph as shown in the image.

- Using data visualisation, can you tell which genre has the most songs?



At a Glance

- Data refers to any collection of raw facts, figures, statistics, or information that can be stored and processed by a computer. It can be in different forms, like numbers, text, images, audio, and video etc.
- Literacy refers to the ability to read, comprehend, and use information effectively.
- To integrate data literacy skills into the organisational culture it is important to make data-driven decision a fundamental part of everyday work.
- Designing an evaluation metric for the data literacy program involves creating a structured framework to assess participants' progress and the effectiveness of the program overall.
- Data privacy referred to as information privacy is concerned with the proper handling of sensitive data, including personal data and other confidential data.
- Data security is the practice of protecting digital information from unauthorised access, corruption, or theft, throughout its entire lifecycle.
- A strong password is a combination of atleast 8 characters with upper and lower-case letters, numbers, and special characters that are difficult for unauthorised individuals or automated programs to guess or crack.
- Encryption is a security technique that transforms readable data (plaintext) into an unreadable format (ciphertext) using an algorithm and an encryption key.
- Data disposal refers to the process of securely destroying or deleting data that is no longer needed to prevent unauthorised access, recovery, and misuse.
- Using Firewall and Antivirus software can stop and alert users to any suspicious activity happening on their devices.
- Cyber security involves protecting computers, servers, mobile devices, electronic systems, networks, and data from harmful attacks.
- Data augmentation is the process of increasing the amount and diversity of data. We do not collect new data, rather we transform the already present data.
- Data scraping is the process of collecting data from websites using software.
- Data processing refers to the manipulation and transformation of data into useful information through various techniques and methods.
- Data interpretation involves examining the data, identifying patterns, trends, and relationships, and translating the findings into actionable information or decisions.
- Data analysis is to examine each component of the data in order to draw conclusions.
- Tableau is a powerful data visualisation and business intelligence tool for visualising and analysing data in order to aid in business choices.

Exercise

Solved Questions

SECTION A (Objective Type Questions)

AiQuiz

A. Tick (✓) the correct option.

1. Which of the following is not an example of data?
   a. Audio ○ b. Video ○
   c. Text ○ d. Hardware ○
2. The ..... illustrates the progressive transformation of raw data into actionable wisdom.
   a. Data ○ b. Data literacy ○
   c. Data pyramid ○ d. Information ○
3. The data pyramid begins with ..... .
   a. Top level ○ b. Raw data ○
   c. Information ○ d. Knowledge ○
4. Data literacy enhances ..... ability in individuals based on evidence.
   a. Programming ○ b. Understanding ○
   c. Decision-making ○ d. Information ○
5. Designing an ..... metric for the data literacy program involves creating a structured framework.
   a. Mathematical ○ b. Logical ○
   c. Skill ○ d. Evaluation ○
6. ..... is about hunting for valuable information in different places, checking if it's good quality, and making sense.
   a. Data discovery ○ b. Data investigation ○
   c. Data quality ○ d. Data literacy ○
7. ..... can recognise objects, people, and even actions happening in videos.
   a. NLP ○ b. Data science ○
   c. Data ○ d. Computer vision ○
8. Which of the following is not the method of data collection in qualitative data interpretation?
   a. Record keeping ○ b. Observation ○
   c. Case studies ○ d. Driving ○
9. ..... should be organised in a way that makes sense so that it can be used effectively.
   a. Data ○ b. Knowledge ○
   c. Privacy ○ d. Ethics ○
10. ..... should not have duplicates, missing values, outliers, and other anomalies so that its reliability and usefulness for analysis is not affected.
    a. Text data ○ b. Clean data ○
    c. Visual data ○ d. Ethical ○

B. Fill in the blanks.

1. ..... refers to any collection of raw facts, figures, statistics, or information that can be stored and processed by a computer.
2. ..... is a person who can interact with data to understand the world around them.
3. ..... can equip individuals with skills and knowledge to improvise in a data-driven world.
4. The ..... provides a comprehensive and structured approach to develop the necessary skills for using data efficiently with all levels of awareness.
5. ..... means increasing the amount of data by adding copies of existing data with small changes.
6. The data generated from the experiment is an example of ..... .
7. Tableau is a powerful data visualisation and ..... tool.
8. In ..... data is represented systematically in the form of rows and columns.
9. Quantitative data interpretation is made on ..... data.
10. In ..... data collection method, data is collected on the same data source repeatedly over an extended period of time.

C. State whether these statements are true or false.

1. Data literacy framework is an iterative process. .....
2. Data analysis is used to examine each component of the data in order to draw conclusions. .....
3. Qualitative data tells us about the numbers of the data. .....
4. Data from people's experience is a data collection method in quantitative data. .....
5. In a pie graph, data is represented using vertical and horizontal bars. .....
6. Data interpretation helps in making informed decisions by providing a clearer picture of the situation. .....
7. Descriptive statistics are not used in quantitative data analysis. .....
8. Reporting is one of the steps involved in qualitative data analysis. .....

SECTION B (Subjective Type Questions)

A. Short answer type questions:

1. From the given image answer the following questions:

A	B	C	D	E	F

In the given image typical levels of awareness in a data literacy process framework are shown.

Identify the labels marked as A, B, C, D, E, F.

Ans. A-Plan

B-Communicate

C-Assess

D-Develop Culture

E-Prescriptive Learning

F-Evaluate

2. What is prescriptive learning?

Ans. Prescriptive learning refers to an educational approach that focuses on guiding students towards specific outcomes or behaviors through structured instruction and targeted interventions based on data and analysis of their learning needs.

3. What is data acquisition? Give an example.

Ans. Data acquisition, also known as acquiring data, refers to the procedure of gathering data like raw facts, figures or statistics from relevant sources either for reference or for analysis as needed in AI projects. For example: collection of data to predict the topper of the school in the upcoming board examination.

4. Name the sources of data acquisition.

Ans. Sources for acquiring data can be primary or secondary.

5. What do you mean by Independent variables?

Ans. Independent variables (sometimes called predictor variables) are those that are used to generate predictions about or to account for the variation in the dependent variable (the goal).

6. What role does Tableau play in data presentation?

Ans. Tableau is a powerful tool for visualising and analysing data, aiding in business decisions by creating various charts, graphs, maps, and dashboards.

7. Why is it important to choose the appropriate measurement scale for data analysis?

Ans. Choosing the correct scale ensures accurate measurement and representation of data, leading to valid analysis results.

8. Describe a scenario where identifying needs through data interpretation can lead to reduced costs.

Ans. A restaurant owner could use customer feedback data to modify or remove unpopular dishes from the menu, reducing waste and costs.

9. What are some common features of bar graph and line graph?

Ans. Both graph types represent data visually, with bar graphs using bars and line graphs using points connected by lines to show changes over time.

10. Give an example of a situation where record keeping would be a useful data collection method.

Ans. Using library documents as reliable and curated sources of information for data collection.

B. Long answer type questions:

1. Give the impacts of data literacy in education and business?

Ans. Data literacy has an immense impact on various aspects of society like business, education, healthcare, and public policy, some of them are given here:

- **Business:** It improves the decision making skills of a person. Data-literate employees can effectively analyse data to gain insights into market trends, customer behaviours, and operational performance.
- **Education:** It empowers the teaching-learning process. Students can engage more deeply with course material, particularly in STEM fields.

2. List down the ways that will help you to become data literate.

Ans. Here is a guide to help you become data literate:

- **Understand the Basics:** Start from learning the concepts of data, types of data, and how it can be used.
- **Learn Data Analysis Tools:** There are many data analysis apps available, that can be learned in order to understand the impact of right data.
- **Gain Statistical Knowledge:** Statistics play a vital role in data literacy. Its one of the vital components that must be learned before you dive into the data driven world.
- **Use Data Visualisation:** Understand the techniques of data visualisation such as Graphics and Charts. Tools like Tableau, matplotlib, python can be used effectively for this purpose.

- **Learn Data Manipulation:** Understanding how to manipulate data to meet the requirements is also one of the key factors. Methods like filtering, sorting, grouping, and omitting are essential for extracting insights from large data set.
- **Practise Cleaning:** Learning to remove data redundancy and data inaccuracy is essential to be data literate.

3. What are the steps involved in Data Acquisition?

Ans. The three key steps involved in Data Acquisition are as follows:

i. **Data discovery:** It is about hunting for valuable information in different places, checking if it's good quality, and making sense of what we find.

ii. **Data augmentation:** It is the process of increasing the amount and diversity of data. We do not collect new data, rather we transform the already present data. Data augmentation means increasing the amount of data by adding copies of existing data with small changes.

iii. **Data generation:** It refers to generating or recording data using sensors. Recording temperature readings of a building is an example of data generation. Recorded data is stored in a computer in a suitable form.

4. Explain the importance of having a clear structure in data and provide examples of good and poor data structure.

Ans. Clear structure in data ensures it is organised logically, facilitating efficient analysis and interpretation. For example, marks of students arranged in a spreadsheet is a good structure, whereas a poor structure example if the student records were stored in a disorganised manner, with inconsistent naming conventions or missing attributes, it would impede data analysis and decision-making processes.

5. Why is data privacy important?

Ans. It is important because:

- A data breach at a government agency can put top secret information in the hands of an enemy state.
- A breach at a hospital can put personal health information in the hands of those who might misuse it.
- A breach at a corporation can put proprietary data in the hands of a competitor.
- A breach at a school can cause inconvenience to the parents, such as constant calling from tuition and coaching centers that leads to disturbance.

6. Explain the term computer vision and the type of data used in this ?

Ans. Computer vision is like giving eyes to computers. It helps them look at pictures and videos from the real world and understand what they're seeing. With Computer Vision, computers can figure out what's in a picture or video, just like we do with our eyes. They can recognise objects, people, and even actions happening in videos.

Types of data used in computer vision include:

- **Image Data:** Digital images captured by cameras or satellite imagery, and medical scans.
- **Video Data:** Video data captured using camera, and surveillance footage.

C. Competency-based/Application-based questions:

#Problem Solving & Logical Reasoning

1. Your teacher has asked students to give the choice of at least 3 co-curricular activities from the given list:

a. Painting
b. Music - Western
c. Music - Indian
d. Dance - Western
e. Dance - Indian
f. Best out of waste
g. English Theatre
h. Hindi Theatre

You're provided with a dataset containing errors, duplicates, and missing values. How would you approach organising and cleaning this data to ensure its reliability and usefulness for analysis?

Outline the steps you would take to organise and clean the dataset, ensuring that it is free from errors, duplicates, and missing values. Additionally, describe any methods or techniques you would use to address these issues and ensure the dataset's reliability and usefulness for analysis.

Ans. Organising and cleaning the dataset containing co-curricular activities involves several steps to ensure it is free from errors, duplicates, and missing values, thus making it reliable and useful for analysis.
Initial Assessment: Review dataset structure and identify errors, duplicates, and missing values.
Standardisation: Normalise activity names and correct spelling inconsistencies.
Duplicate Removal: Identify and remove exact duplicates of activities.
Missing Values: Impute missing data using appropriate methods like mode for categorical values.

Validation: Cross-verify cleaned data against original sources for accuracy.
Quality Assurance: Ensure data consistency and document cleaning steps for transparency.
Export: Save cleaned dataset in a suitable format (e.g., CSV) for analysis.
Final Check: Validate data integrity post-export to ensure reliability for analysis.

2. **Assertion and Reasoning Questions:**

Direction: Question 2, consist of two statements – Assertion (A) and Reasoning (R). Answer these questions by selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

Assertion (A): Cleaning data is a crucial step in the data analysis process.

Reasoning (R): Data cleaning ensures that the dataset is free from errors, duplicates, and missing values, which enhances the reliability and accuracy of subsequent analysis.

Ans. a

Unsolved Questions

SECTION A (Objective Type Questions)

AI Quiz

A. Tick (✓) the correct option.

1. Data literacy is able to cultivate ..... skills to understand and explore data's implications by questioning assumptions.

   a. critical thinking ○ b. programming ○

   c. awareness ○ d. probability ○

2. Data literacy fuels ..... by providing tools and techniques to explore data from different perspectives.

   a. errors ○ b. comprehension ○

   c. innovation ○ d. repetition ○

3. ..... enables users to tackle complex problems and derive meaningful relevance.

   a. Mathematics ○ b. Trends ○

   c. Project cycle ○ d. Data literacy ○

4. Data literacy has an impact on which of the following?

   a. Public policy ○ b. Cooking ○

   c. Driving ○ d. Jogging ○

5. By implementing a ..... learning approach, organisations can provide a set of diverse resources that align with individual learning styles.

   a. modern ○ b. prescriptive ○

   c. planned ○ d. latest ○

6. The process of collecting data from websites using software is called ..... .

   a. Data analysis ○ b. Data reference ○

   c. Data literacy ○ d. Data scraping ○

7. ..... is the process of increasing the amount and diversity of data.

   a. Data augmentation ○ b. Data filtering ○

   c. Data processing ○ d. Data modelling ○

8. Digital images captured by cameras or satellite imagery, medical scans, and surveillance footage is ..... .

a. Text data ◯ b. Numeric data ◯

c. Computer vision ◯ d. Audio data ◯

9. ..... is the process of making sense out of a collection of data that has been processed.

a. Data interpretation ◯ b. Data scrapping ◯

c. Data validation ◯ d. Data handling ◯

10. The ..... is the first step of data handling.

a. Plan ◯ b. Acquire ◯

c. Present ◯ d. Process ◯

B. Fill in the blanks.

1. ..... refers to the ability to read, comprehend and use information effectively.
2. ..... is essential because it enables individuals to make informed decisions, think critically, solve problems, and innovate.
3. ..... is a conceptual model that illustrates the hierarchical structure of data processing.
4. ..... data sources are the external sources for collecting data, rather than generating it personally.
5. ..... refers to generating or recording data using sensors.
6. ..... is all about teaching computers to understand and work with human language.
7. ..... are also called the characteristics or properties of the data.
8. Application involves putting acquired knowledge and ..... into practice in real-world contexts.
9. ..... is a combination of upper and lower-case letters, numbers, and special characters that are difficult for unauthorised individuals or automated programs to guess or crack.
10. ..... refers to the process of creating copies of data to ensure that it can be restored in the event of data loss due to natural disasters, accidents, cyber-attacks, or other unexpected events.

C. State whether these statements are true or false.

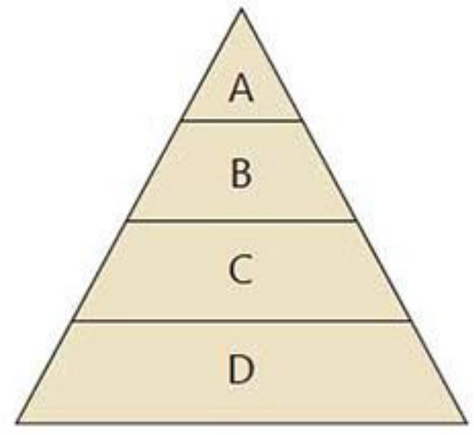
1. Data analysis is a common method for extracting information from websites. .....
2. Recording temperature readings of a building is an example of data generation. .....
3. Data augmentation is the process of increasing the amount and diversity of data. .....
4. Secondary data includes data taken from surveys, interviews, experiments, etc. .....
5. Good data has information scattered. .....
6. Highest level of understanding involves critical thinking to interpret data and make good consistent decisions. .....
7. Accurate data closely reflects actual values with errors. .....
8. Data interpretation involves collecting the data. .....

D. Match the following:

1. Computer Vision	a. Data scraping
2. NLP	b. Image Data
3. Textual Data	c. Dataset search
4. Sources of data	d. Data history
5. Data Discovery	e. Qualitative Data

SECTION B (Subjective Type Questions)

A. Short answer type questions:



1. Image of a data pyramid is given here. Based on it, answer the following questions:
   i. What is a data pyramid?
   ii. Name the areas marked as A, B, C, and D in the data pyramid.
   iii. Give one important feature of each level.
2. Why is data literacy essential? List any two factors.
3. How can pie charts be useful in data presentation?
4. How does informed decision-making benefit from data interpretation?
5. What is the difference between qualitative and quantitative data?
6. What is the purpose of data processing?
7. What is Kaggle and how can it be useful for data enthusiasts?
8. Define the term "Data Backup".
9. Why is the data literacy framework an iterative process?
10. Give any two best practices that can help you ensure data privacy.

B. Long answer type questions:

1. What are the ethical concerns while doing data acquisition?
2. Why is data security important?
3. How is data security related to AI?
4. List any three best practices of cyber security.
5. Explain with example the two types of numeric data.
6. Explain in short the types of data used in three domains of AI.

C. Competency-based/Application-based questions:

#Problem Solving & Logical Reasoning

The following dataset represents the students' academic performance, identify which features in the dataset would be considered independent variables and which would be dependent variables in predicting students' final exam grade.

Stud Name	Study Hours	Attendance	Previous Grades	Extracurricular Activity	Final Exam Grade
Aarav	5	Yes	B	Sports	A
Riya	7	Yes	A	Debate Club	B
Arjun	6	No	C	Music Club	C
Ishan	4	Yes	B	Drama Club	B
Anaya	8	Yes	A	None	A

1. Examine the following datasets:

Quantitative Data:

Number of petals on a flower:
Rose: 32
Lily: 24
Sunflower: 89
Tulip: 16

Height of flowers (in centimeters):
Rose: 45
Lily: 55
Sunflower: 120
Tulip: 30

Qualitative Data:

Colour of flowers:
Rose: Red
Lily: White
Sunflower: Yellow
Tulip: Pink

Fragrance intensity:
Rose: Strong
Lily: Mild
Sunflower: None
Tulip: Moderate

These datasets contain both quantitative data (number of petals and height) and qualitative data (colour and fragrance intensity) for different types of flowers (Rose, Lily, Sunflower, Tulip).

a. Discuss the differences between quantitative and qualitative data interpretation.

b. Describe the methods and techniques commonly used for interpreting quantitative and qualitative data, highlighting their respective strengths and limitations.

2. You are tasked with analysing the performance of a company's sales across different regions over the past year. How would you utilise data visualisation techniques to present this information effectively to the company's stakeholders during a quarterly review meeting? Describe the types of visualisations you would use and explain how they would help convey the sales trends and patterns to the audience.

Ai In Life

#Experiential Learning

1. Prepare a questionnaire using Padlet.com, to know how data literacy is helpful in education.
2. Make a presentation to depict the "Data Literacy Process Framework".

Ai Deep Thinking

#Creativity & Innovativeness

1. In today's digital age, data has become an incredibly valuable resource, much like gold was during the gold rush era. In the context of Artificial Intelligence (AI), data is the raw material that fuels AI systems, How?
2. Who first said that Data is a new gold? Is data more precious than the gold? Justify

Ai Lab

#Experiential Learning

Ask students to collect data of different coloured objects in the Lab and record it in a spreadsheet. Create a basic bar chart to visualise the collected data using spreadsheet software. Later, ask students to present their bar charts, followed by a brief discussion on the importance of data quality and ethical considerations in AI.

Answers

Exercise (Section A)

A. 1. d 2. c 3. b 4. c 5. d 6. a 7. d 8. d 9. a 10. b

B.
1. Data
2. Data literate
3. Data literacy
4. Data literacy framework
5. Data augmentation
6. Primary data
7. Business intelligence
8. Tabular DI
9. Numeric
10. Longitudinal studies

C.
1. True
2. True
3. False
4. False
5. False
6. True
7. False
8. True

Answer the following questions:

1. Why do you think there's a need to educate students about data literacy?

2. Why is data privacy important? Give an example.

3. What are the 3 C's of data literacy?

4. What is meant by cyber attack? Give an example of it.

UNIT-3

MATHS FOR AI (STATISTICS & PROBABILITY)

Learning Outcomes

- How are Maths and AI Related?
- Statistics
- What is Probability in Statistics?
- Essential Mathematics for AI
- Application of Statistics
- Applications of Probability

Mathematics is crucial to Artificial Intelligence (AI) because it provides the theoretical foundation and practical tools for developing, assessing, and optimising AI systems. It is the backbone of AI algorithms and models, empowering machines to process, analyse, and interpret vast amounts of data.

In general, Mathematics guarantees that AI models are precise, effective, and able to resolve challenging issues.

How are Math and AI related?

Mathematics and AI are interconnected fields, with Mathematics supplying the theoretical foundations for many AI algorithms. Patterns are repeating designs or sequences that can be observed in numbers, shapes, images, languages, or objects in our surroundings. They follow a specific order or arrangement, making them easily recognisable. Mathematics aids in the study of these patterns. These patterns allow you to solve puzzles. They help identify an order or arrangement in lists of images or numbers. They are present everywhere around us.

Patterns in Numbers

Number patterns, often simply referred to as patterns, are sets of numbers that follow a specific order or rule. There are various types of number patterns, including Fibonacci, geometric, algebraic, and arithmetic patterns.

Some tricks are given below for finding the patterns in numbers:

- **Number Sequences:** Look for a sequence where each number is related to the one before it in a specific way. This could be:
  - **Adding** a constant value (e.g., 1, 4, 7, 10... +3 each time)
  - **Multiplying** by a constant value (e.g., 2, 4, 8, 16... x2 each time)
  - **Following a formula** (e.g., 2n + 1: 3, 5, 7, 9...)
- **Series:** Analyse a series of numbers to identify the underlying rule for example square series, cube series, etc.
- **Even or Odd:** Is the sequence made of even numbers (2, 4, 6...) or odd numbers (1, 3, 5...)?
- **Prime or Composite:** Are the numbers prime (only divisible by 1 and itself) or composite (divisible by more than two numbers)?
- **Fibonacci Sequence:** This famous sequence starts with 0 and 1, and each subsequent number is the sum of the two preceding numbers (0, 1, 1, 2, 3, 5, 8...).

Patterns in Images

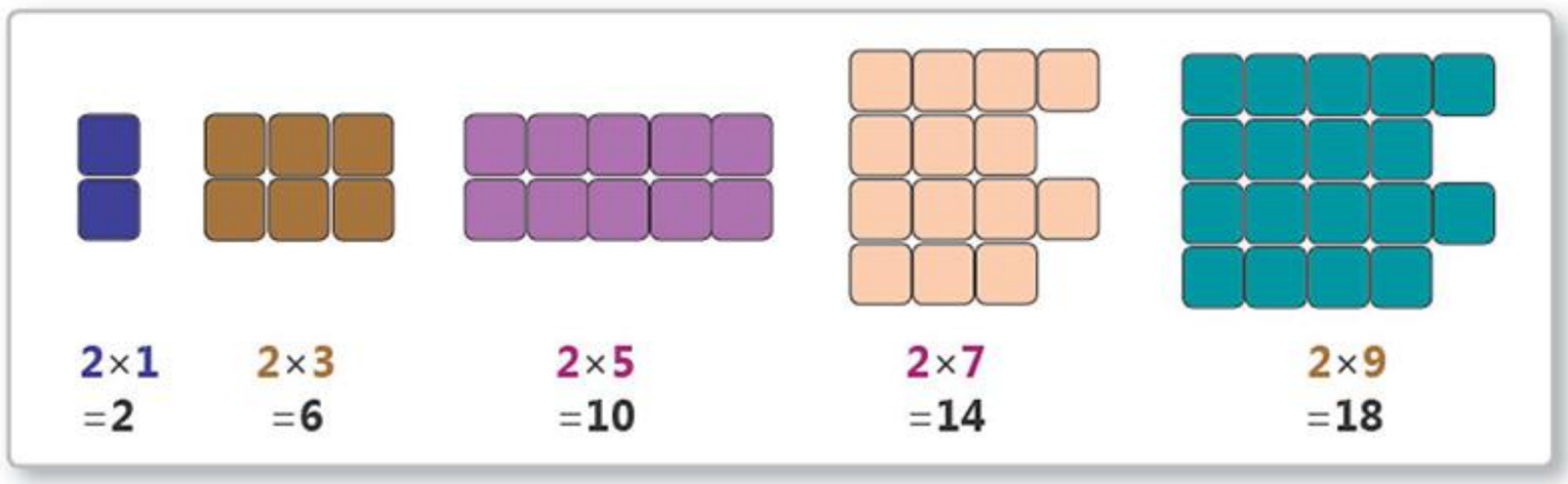
Patterns in images refer to recurring visual elements or structures that can be recognised and analysed within the context of an image. These patterns can be detected and utilised for various purposes, including image recognition, classification, compression, and enhancement.

- **Repeating shapes:** Look for shapes that appear multiple times in the image.
  Are they of the same size and colour?
  Do they form a larger shape?
- **Symmetry:** Does the image have a mirror effect where one side reflects the other?
  Is it symmetrical vertically, horizontally, or both?
- **Colour patterns:** Are there repeating colours or a specific colour scheme used?
  Do the colours alternate or follow a gradient?
- **Progression:** Do the elements in the image change in size, colour, or position in a predictable way?

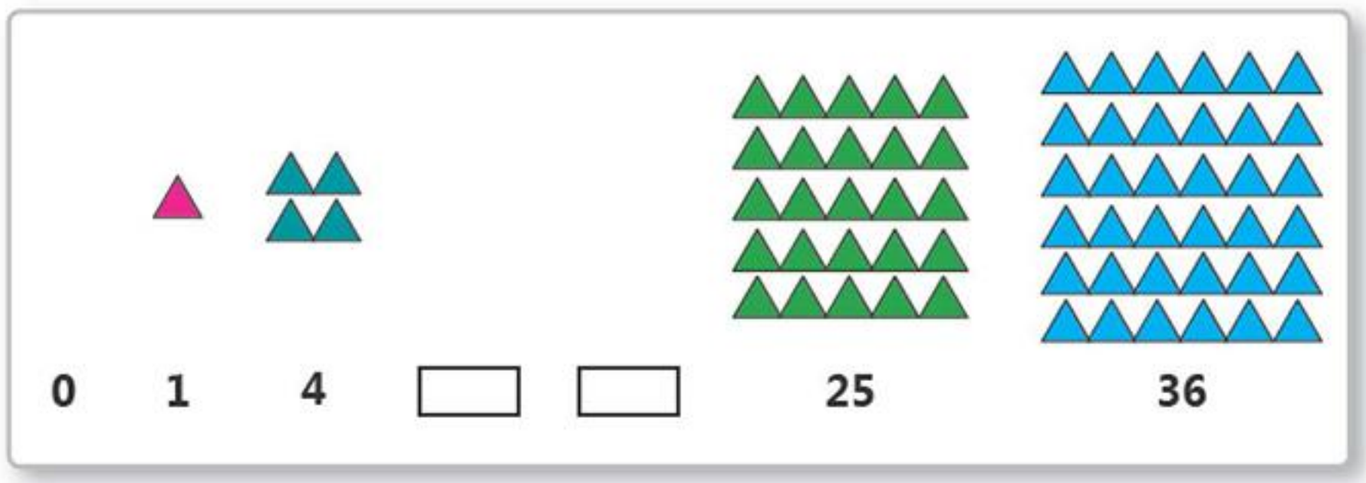
Ai Task

#Problem Solving & Logical Reasoning

1. Observe the pattern in the given image?



2. Find the missing numbers in the given series and draw the pattern.



3. Which skill did you use to identify the pattern in above question?

Artificial Intelligence helps computers to understand and recognise patterns, much like how humans do. Just as we learn to recognise patterns in different things we see or hear, AI can do the same with various types of data, whether it's numbers, images, or even speech and text. These patterns help AI to solve puzzles – like identifying dogs and muffins, or predicting floods, earthquakes, etc.

Ai Task

#Problem Solving & Logical Reasoning

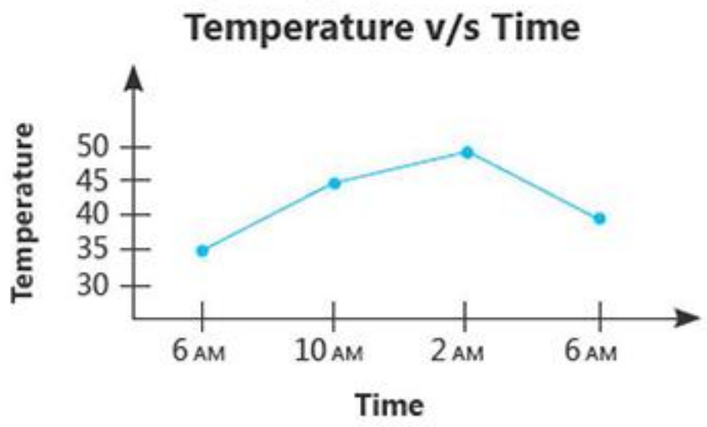
Let's think and answer a few more!

1. Find out the middle value from the given numbers?
   2, 5, 8, 11, 14

2. Fill in the missing number and find the next number in the given series?

   3, 6, 12, 24, ___, 96, ___

3. Identify the highest temperature in the given graph and mention the time of it.



4. How many faces are there in a dice?

5. How many sides does a coin have?

6. What is the shape of a ball?

Essential Mathematics for AI

Math will help us to better understand AI and its way of working, but what kind of math is needed for AI? The kind of math needed for AI includes:

1. **Probability and Statistics (exploring data):** Probability theory and statistics are key fundamentals for many AI algorithms, particularly those involving machine learning. It is useful in tasks such as natural language processing, computer vision, and decision-making.
2. **Linear Algebra (finding out unknown or missing values):** Linear algebra is involved in large-scale data processing playing a vital role in machine learning and AI. It performs operations in neural networks, image processing, and data transformations.
3. **Calculus (training and improving AI model):** Calculus is essential for understanding the best possible solution algorithms used in machine learning. It minimise mistakes and maximise the parameters of machine learning models.
4. **Graph Theory:** Graph theory is used in AI representing trends using data visualisation.

5. **Information Theory:** Information theory provides mathematical tools for data analysis.
6. **Logic and Set Theory:** Logic and set theory are used in concepts like expert systems, database systems, and knowledge graphs. Mathematics and AI are deeply integrated fields, with mathematics providing the theoretical foundation for many AI algorithms and techniques.
7. **Algorithm design:** The design of the algorithms often uses mathematical principles and structures such as functions, matrices and graphs.

Statistics

Statistics is used for collecting, exploring, and analysing the data. It also helps in concluding data. It enables AI systems to detect patterns, identify relationships, and infer conclusions from data.

- Data is collected from various sources.
- Data is explored and cleaned to be used.
- The analysis of data is done to understand it better.
- Conclusions and decisions can be made from the data.

Let's consider an example to illustrate these steps:

A school wants to improve the performance of its students and decides to collect data on study habits and grades.

- **Collecting Data:** The school conducts a survey where students report the number of hours they study each week and their grades in various subjects.

- **Exploring and Cleaning Data:** The school first looks at the data to find patterns, like the range of study hours and grades.

  They also clean the data by fixing any missing or incorrect information (e.g., if some students didn't fill in all the fields or gave unrealistic answers).

- **Analysing Data:** The school summarises the average study hours and grades to get an overview. They also check if there is a significant relationship between study hours and grades.

- **Drawing Conclusions:** The analysis might reveal that students who study for more hours tend to have higher grades. Based on this conclusion, the school might decide to implement study support programs to encourage students to study more.

Thus, we can say statistics helps in transforming the raw data into meaningful insights, enabling better decisions and strategies in various fields such as business, healthcare, education, and more.

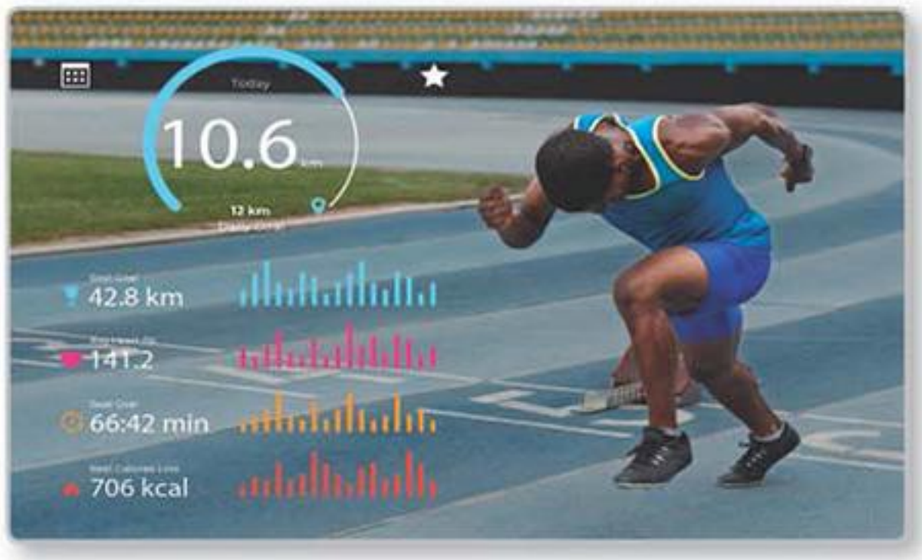
Brainy Fact

As per the statistics, Netflix makes $1 billion annually from automated personalised recommendations.

Application of Statistics

Statistics can be used in numerous fields because of its ability to extract meaningful insights from data and assist in decision-making. Let us discuss some of the fields where statistics is used.

Sports



- Statistics helps you assess how well players perform, how teams plan their games, and the results of matches.
- Statistics gives data that helps you make smart decisions about hiring players, training them, performance monitoring, preventing injury, and planning game strategies.
- Studying opponents' strengths and weaknesses to devise better game plans.
- The Tokyo 2020 Olympics were postponed due to the developing global situation of the Covid-19 pandemic. Statistics revealed that COVID cases sharply increased in Japan during the planned period of the Olympics.

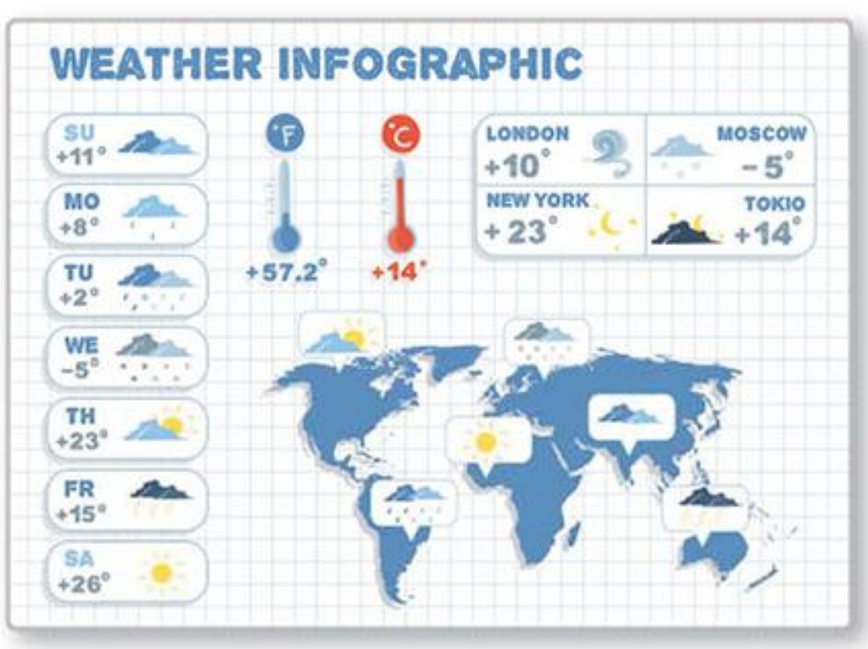
Education

- Analysing test scores and grades to evaluate student learning, identify areas for improvement, and allocate resources effectively.
- Using data to identify gaps in the curriculum and areas where students need more support.
- Analysing how students and teachers use educational technology for future implementations.
- Statistics helps in determining the average skills of students in a particular school or grade. This information shows which areas need more focus to help improve education strategies.

Disaster Management

- Authorities use statistics in analysing existing risks and alert the citizens residing in places that might be affected by a natural disaster in the near future.
- The disaster management teams use statistics to know about the population, and about the services and infrastructure present in the affected area.
- Statistics are used to study trends in disaster occurrence and impact to adapt strategies over time.
- Statistics are used to design and evaluate public education campaigns to raise awareness and preparedness levels.

Weather Forecast



- Statistical summaries create easy-to-understand weather forecasts for the public.
- Statistics compare the weather conditions with information about past seasons and conditions.
- Statistical methods are used to analyse long-term climate data and detect trends related to global warming and climate change.
- Statistics are used to predict the future based on data from the past and provide forecasts that express the likelihood of various weather events (e.g., "There is a 70% chance of rain tomorrow").

Disease Prediction

- Statistical models are used to predict the spread and impact of infectious diseases, such as influenza, COVID-19, and Ebola.
- Data analysis creates epidemic curves that show the progression of disease outbreaks over time.
- The US government uses statistics to understand which disease is affecting the population the most. This helps them in curing these diseases more effectively. To understand the extent of any of the infectious diseases in a given population.

For example, the government can analyse the areas where COVID cases are increasing, or where the vaccination drive needs to be improved.

Options of Voters

- Statistics are used in elections to enhance transparency for voters and encourage voters to participate in elections.
- By surveying a group of voters and analysing the results, statistics can reveal what the majority of people think about political candidates, policies, or upcoming elections. This helps politicians and decision-makers to understand public opinion.
- Statistics play an important role in Election Forecasts, making Campaign Strategies and micro-target individuals based on available data.

Ai Reboot

Explain any two applications of statistics in education.

What is Probability in Statistics?

Probability is a branch of statistics that deals with the likelihood or chance of an event to happen or different outcomes occurring in a given situation.

- It measures the amount of certainty of an event.
- It helps us make predictions about future events based on the data we have.
- It helps us understand how likely something is to happen.

The formula for probability is given as the ratio of the **Number of Favourable Outcomes** to the **Total Number of Possible Outcomes.**

$$P(A) = \frac{\text{Number of Favourable Outcomes}}{\text{Total Number of Possible Outcomes}}$$

Where, P(A) - is probability of happening of an event (A)

Let us understand it using the example of a coin.

When a coin is tossed, there are two possible outcomes: head or tail.
What is the probability of getting a head?

$$P(\text{Head}) = \frac{1}{2}$$

So, we see the chances of getting head is $\frac{1}{2}$ and the chances of getting tail is $\frac{1}{2}$.

Therefore, we conclude that when we toss a coin, there are equal chances of getting a head or a tail.

Let us take another example, consider the probability of rolling a fair six-sided die.
A fair six-sided die has six faces numbered from 1 to 6.
The probability of rolling any specific number (say, 3) on a fair six-sided die is calculated as,
Number of favourable outcomes (rolling a 3) = 1
Total number of possible outcomes = 6 (since there are 6 faces on the die)
So, the probability of rolling a 3 on a fair six-sided die is:

$$P(6) = \frac{\text{Number of Favourable Outcomes}}{\text{Total Number of Possible Outcomes}} = \frac{1}{6}$$

Can you find the probability of getting an even number in a Dice?

Ai Task

#Experiential Learning

Let's understand probability with the following activity.
Purpose: To understand the possibility of occurrence of an event.
Case 1: Varun went to the park to play football. Which pet is he more likely to see, a cat or a dog?

(A) Cat (B) Dog

Case 2: It's Ankita's birthday; which sweet is she most likely to distribute toffee or chocolate to her friends in class?

(A) Chocolate (B) Toffee

Case 3: In the summer, Veer starts to drive and reaches a diversion, where one road takes him to Sunny Beach and the other takes him to the mountains. What is the probability that he would select the mountain road?

(A) Beach Road (B) Mountain Road

Ai Task

#Experiential Learning

About the Game

A deck containing 52 cards is grouped into four suite has clubs, diamonds, hearts, and spades. Each of the suite has 13 cards each, which sum up to 52.

Game Structure

Find the probability of drawing a heart from a standard deck of 52 cards?

_____

_____

What is the probability of drawing a spade or diamond from a standard deck of 52 cards?

_____

_____

When discussing probability, we often rely on specific terms to describe the likelihood of events occurring. Let us discuss the specific terms in detail.

Certain Events

These events are guaranteed to happen; there is no doubt about their occurrence. It will have a probability of 1. For example:

- If you flip a fair coin, the probability of it landing heads up or tails up is certain, as one of these outcomes is guaranteed.
- The occurrence of sunrise and sunset each day is certain.
- When you click a light switch, the light bulb will either turn on or off.
- The act of inhaling and exhaling is certain as long as a person is alive.
- Time consistently moves forward, and each passing moment is certain.
- The beating of the heart is a certain event, as long as a person is alive.
- If it is Sunday today, it is certain, tomorrow is going to be a Monday.

Likely Events

These events have a higher probability of occurring as compared to other events. For example:

- If you roll a fair six-sided die, the likelihood of rolling a number greater than 2 (3, 4, 5, or 6) is higher than rolling a number less than or equal to 2 (1, or 2).
- If you visit a store known for carrying a wide variety of brands, it's likely that you'll find your favourite brand among their products.
- If you study well for an exam, you're more likely to pass with good grades.
- If you buy many raffle tickets compared to others, you're more likely to win a prize.

Unlikely Events

These events have a lower probability of occurring compared to other events. For example,

- If you randomly select a card from a standard deck, the probability of drawing an ace of spades is lower compared to drawing a card of a different suit.
- Observing a shooting star in the night sky is an unlikely event compared to seeing regular stars.

- Getting into a really good university, especially one that's really hard to get into, is not very likely because there are so many people applying.
- If a board result is declared, the chances to be the topper of the school is very unlikely as there is only one topper in the school.

Impossible Events

These events have no chance of occurring; they are not feasible outcomes. The event will never happen or is impossible, it will have a probability of 0. For example,

- Rolling a fair six-sided die to get a number greater than 6 or less than 1.
- Drawing a card from a standard deck and it turns out to be orange in colour.
- The probability that you can pick a red ball from a bag containing only blue balls is 0.
- Picking a random day of the week, and it turns out to be both Monday and Friday at the same time.
- Picking a guava in an orchard of apples.
- The probability of a fish to climb a tree is an impossible event.

Equal Probability Events

In this scenario, each event has an equal chance of occurring. For example,

- If you roll a fair six-sided die, the probability of rolling any specific number (1, 2, 3, 4, 5, or 6) is the same because each face of the die has an equal chance of landing face up.
- To guess a number between 1 and 10, each number has an equal probability of being selected.
- The chances of selecting a particular coloured marble from a bag of marbles containing the equal number of red, blue, and green marbles are equal.
- When students enter in a classroom and select their seats, each desk or chair has an equal chance of being chosen.
- Selecting a boy or a girl from a class having equal number of girls and number of boys has an equal probability.

The probability of an event occurring is somewhere between impossible and certain. If an event is certain or sure to happen, it will have a probability of 1.

For example, the probability of taking out a yellow ball from a box containing 10 yellow balls is 1. If an event will never happen or is impossible, it will have a probability of 0. For Example, taking out green ball from a box containing 10 yellow balls is 0.

So, the probability of an event occurring lies between 0 and 1.

Ai Task

#Experiential Learning

It's Arshia's birthday and she has a bag full of 7 toffees and 3 chocolates. She asked you to pick one from the bag. (Consider all events as individual.)

Try to fill in the blanks with – likely, unlikely, certainly, impossible, equal probability

1. If you pick from the bag without looking, it is _____ that you will pick toffee.
2. If you pick from the bag without looking, it is _____ that you will pick a chocolate.
3. If you pick from the bag without looking, it is _____ that you will pick a cake.
4. If you remove 4 toffees from the bag, and pick without looking, there is an _____ that you pick a chocolate or a toffee.
5. If you pick from the bag with all toffees removed and pick without looking, you will _____ pick a chocolate.

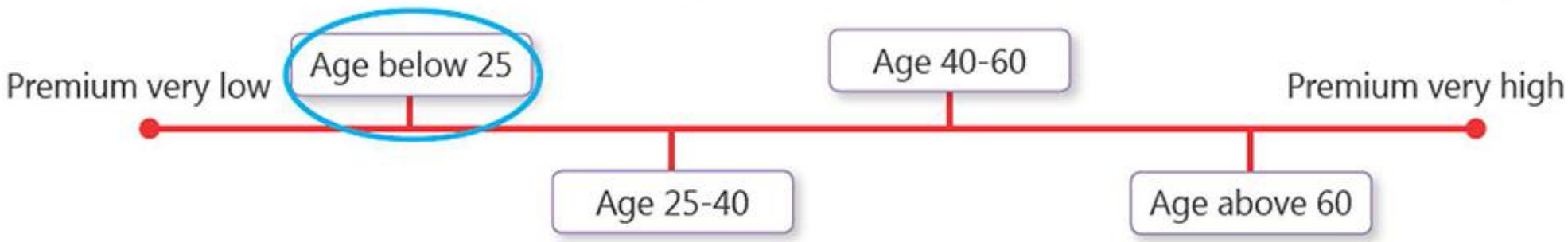
Case 1

Health insurance companies often use probability to determine how likely it is that certain individuals will spend a certain amount on healthcare each year and determine risk factors for contracting a disease and for being cured.

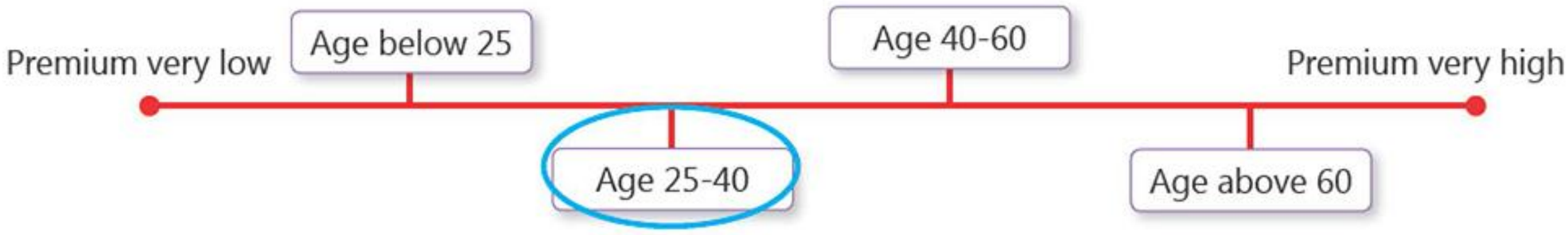
For example, a company might use factors like age, existing medical conditions, current health status, etc. to determine that there's a 90% probability that a certain individual will spend ₹10,000 or more on healthcare in a given year.

Individuals who are likely to spend more on healthcare will be charged higher premiums because the insurance company knows that they'll be more expensive to insure.

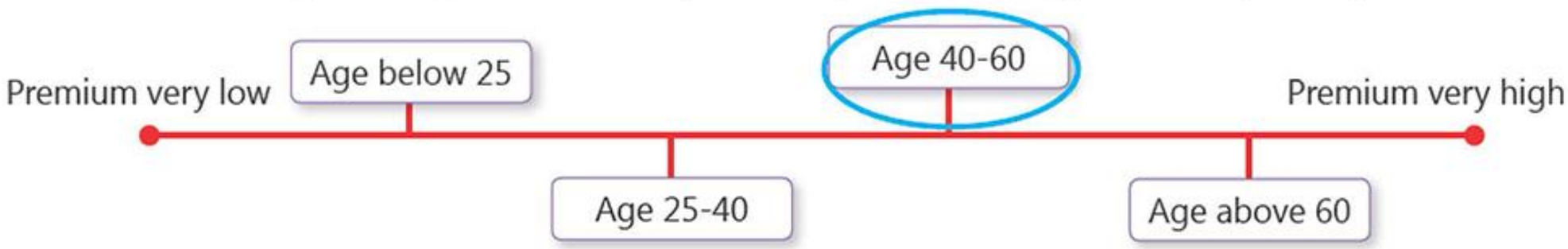
- **Scenario 1**: If the person is young, below 25 years of age, then the insurance premium will be very low.



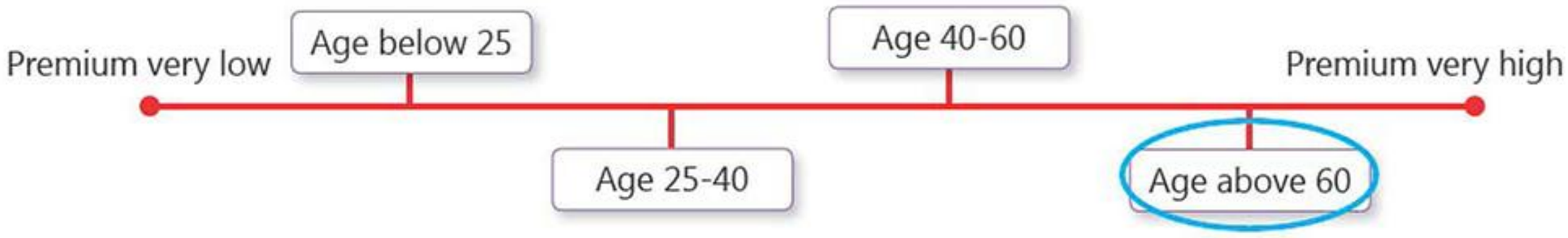
- **Scenario 2**: If the person is middle-aged (25–40), then the insurance premium will be of higher value than that in the first category.



- **Scenario 3**: If the age of the person is 40-60, then the premium charged will be quite high.



- **Scenario 4**: If the person is above 60 years of age then the premium charged is of the highest bracket.



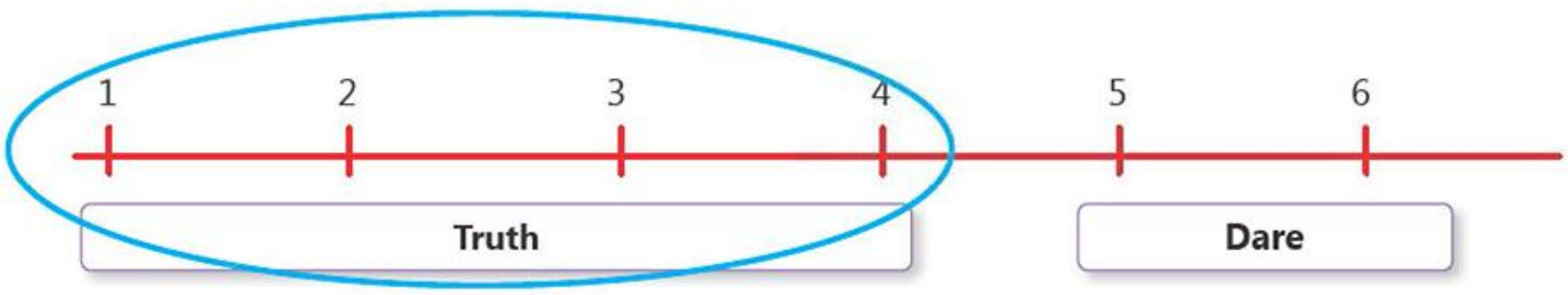
Brainy Fact

GPT-3 (Generative Pre-trained Transformer 3) is a large language model, released by OpenAI in 2020, has 175 billion parameters and uses probabilistic sampling techniques for text generation.

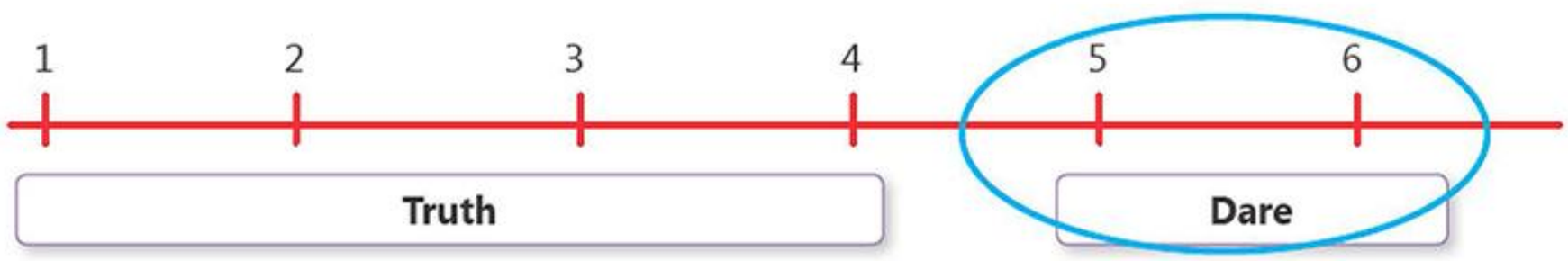
Case 2

Let there be a bet among friends that a person will have to perform a dare if the die rolls out 5 or 6 and otherwise the person has to speak the truth.

- **Scenario 1:** When die rolls into any number between 1-4. The person replies to a question with the truth.



- **Scenario 2:** When the die rolls out 5 or 6 then a person performs a dare.



Applications of Probability

Probability has a wide range of applications across various fields, making it an essential concept in many areas of study and professional practice. Here are some key applications of probability.

Sports

- In cricket, the batting average represents how many runs a batsman would score before getting out. Probability can help in estimating the batting average. For instance, if a batsman had scored 20 runs out of 80 runs from only boundaries in the last match. Then, there is a chance that he will score 25% of his runs in the next match from boundaries.

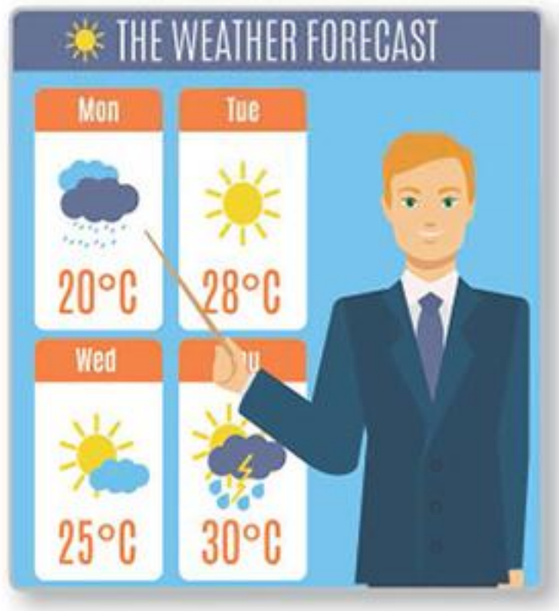
- Probability helps in predicting the outcomes of sports events by analysing historical data and other relevant factors. For example, in football (soccer), the probability of a team winning can be calculated based on home advantage, current form, and historical head-to-head results.
- Coaches and analysts use probability to predict a player's performance. For example, in basketball, the probability of a player making a free throw can be estimated based on their past success rate.
- During games, coaches use probability models to make strategic decisions. For example, in football, when a team scores a touchdown, they have a choice. They can either kick the ball for an easy point or try for a more challenging two-point conversion by running or passing the ball into the end zone again. Coaches use probability to decide which option gives them the best chance of scoring more points.
- Teams with players suited to the ground conditions may have a higher probability of winning. For example, if the nature of the pitch favours batsmen or bowlers, can have a substantial impact.

Weather Forecasting

- Weather forecasters use probability to determine the likelihood of rain, wind, snow, clouds, etc. on a given day in a specific area.

  For example, forecasters may say things like "there is a 70% chance of rain today between 4 PM and 6 PM" to indicate a medium to high likelihood of rain during certain hours.
- Probability helps in understanding long-term climate patterns and changes.

  For example, estimating the probability of extreme weather events under different climate scenarios aids in planning and mitigation efforts.



Traffic Estimation

- People often use probability when they decide to drive to someplace. Vehicular traffic flow is examined and an estimated vehicle waiting time in each direction is estimated through probability.
- Based on the time of day, location in the city, weather conditions, etc. people tend to make probability predictions about how bad traffic will be during a certain time. For example, if you think there's a 90% chance that traffic will be heavy from 6 PM to 7:30 PM in your vicinity then you may decide to wait during that time.

Finance

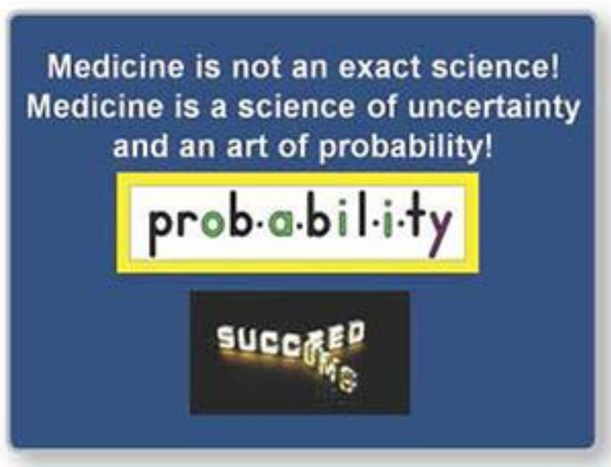
- Probability is used to assess the risk of investments and financial decisions.

  For example, calculating the probability of a stock's return falling within a certain range helps investors make informed decisions.
- Probability models help investors spread their investments across different assets to reduce risk.

  For example, by looking at the chances of returns for various investments, investors can build a balanced portfolio.

- Probability is crucial in figuring out insurance costs and how policies are structured by various insurance agencies.

  For example, actuaries use probability to predict events like accidents or natural disasters and set insurance premiums based on those chances.



Medicine

- Probability helps in understanding how diseases spread and how well treatments work.

  For example, by estimating the chance of disease transmission in different situations, we can better plan public health measures.
- Probability is used to determine the effectiveness of new treatments or drugs.

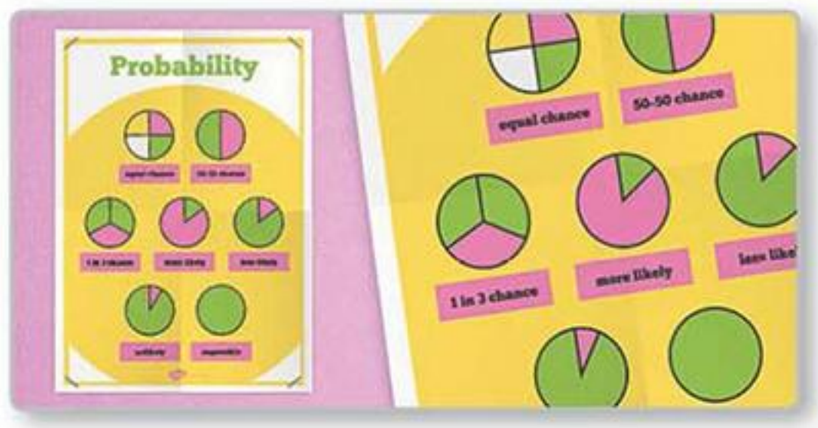
  For example, researchers calculate the probability that observed treatment effects are due to the drug rather than random chance.

Education

- Probability is used to estimate how well students perform in exams based on different factors.

  For example, considering study habits and attendance can predict the chances of students getting certain grades.
- Probability helps create fair and accurate standardised tests.

  For example, figuring out the chances of different scores in tests, it can better reflect how well students understand the subject taught.



At a Glance

- Mathematics is crucial to Artificial Intelligence (AI) because it provides the theoretical foundation and practical tools for developing, assessing, and optimising AI systems.
- Mathematics and AI are interrelated fields, where mathematics provides theoretical concepts to many of the AI algorithms.
- Artificial Intelligence assists computers to understand and recognise patterns, much like how humans do.
- Number patterns, often referred to as patterns, are sets of numbers that fit into a particular order.
- Patterns in images refer to recurring visual elements or structures that can be recognised and analysed within the context of an image.
- Probability theory and statistics are one of the key fundamentals to many AI algorithms, particularly those involving machine learning.
- Linear algebra is involved in large-scale data processing, playing a vital role in machine learning and AI.
- Calculus is essential for understanding the best possible solution algorithms used in machine learning.
- Statistics is used for collecting, exploring, and analysing the data. It also helps in concluding data.
- Statistics can be used in numerous fields because of its ability to extract meaningful insights from data and assist in decision-making.
- Probability is a branch of statistics that deals with the likelihood or chance of different outcomes occurring in a given situation.

Exercise

Solved Questions

SECTION A (Objective Type Questions)

AI Quiz

A. Tick (✓) the correct option.

1. ..... are repeating designs or sequences that can be observed in numbers, shapes, images, languages, or objects in our surroundings.
   a. Patterns ○ b. Iterations ○
   c. Sequences ○ d. Statistics ○
2. Which of the following statements is not true?
   a. Mathematics helps in the study of patterns. ○
   b. With the use of mathematics, you can solve puzzles. ○
   c. Mathematics helps to identify an order/ arrangement in the list of images or numbers. ○
   d. The patterns only exist in mathematics. ○
3. ..... measures the amount of certainty of an event.
   a. Probability ○ b. Calculus ○
   c. Series ○ d. Pattern ○
4. ..... also helps in concluding data.
   a. Statistics ○ b. Information ○
   c. Probability ○ d. Sequence ○
5. The ..... of an event occurring is somewhere between impossible and certain.
   a. possibility ○ b. existence ○
   c. probability ○ d. outcome ○
6. If an event is certain or sure to happen, it will have a probability of ..... .
   a. 0 ○ b. 1 ○
   c. True ○ d. None ○
7. Picking a random day of the week, and it turns out to be both Monday and Friday at the same time. Identify events.
   a. Likely events ○ b. Unlikely events ○
   c. Impossible events ○ d. Certain events ○
8. If you toss a coin, the chance of getting a head or tail is an example of ..... .
   a. equal probability ○ b. unlikely events ○
   c. impossible events ○ d. certain events ○

B. Fill in the blanks.

1. ..... assist computers to understand and recognise patterns, much like how humans do.
2. ..... is used in AI representing trends using data visualisation.
3. ..... is used for collecting, exploring, and analysing the data.

4. ..... is a branch of statistics that deals with the likelihood or chance of different outcomes occurring in a given situation.
5. ..... events have a lower probability of occurring compared to other events.
6. Certain events are guaranteed to happen and have a probability ..... .
7. ..... helps in predicting long-term climate patterns and changes.
8. ..... the famous sequence starts with 0 and 1, and each subsequent number is the sum of the two preceding numbers.

C. State whether the following statement is true or false.

1. Calculus is essential for understanding the best possible solution algorithms used in machine learning. .....
2. Data is collected only from a single source. .....
3. Conclusions and decisions can be made from the data. .....
4. Probability helps create fair and accurate standardised tests. .....
5. Mean is used to determine the effectiveness of new treatments or drugs. .....
6. AI can see patterns only in numeric data types. .....
7. Information theory provides mathematical tools for data analysis. .....
8. Statistical methods are used to analyse long-term climate data and detect trends related to global warming and climate change. .....

SECTION B (Subjective Type Questions)

A. Short answer type questions.

1. What is probability in statistics?

Ans. Probability is a branch of statistics that deals with the likelihood or chance of different outcomes occurring in a given situation.

2. How do you calculate probability?

Ans. The formula for probability is given as follows:

$$P(A) = \frac{\text{Number of Favourable Outcomes}}{\text{Total Number of Possible Outcomes}}$$

3. Define the term "Statistics".

Ans. Statistics is used for collecting, exploring, and analysing the data. It also helps in drawing conclusions from data.

4. Explain the use of statistics in disease prediction.

Ans. Statistics models can predict the spread and impact of diseases, helping in planning public health measures.

5. What is an impossible event? Provide an example.

Ans. An impossible event has no chance of occurring, such as rolling a number greater than 6 on a fair six-sided die.

6. Why is calculus important for AI models?

Ans. Calculus is crucial for training and improving AI models by understanding the best possible solution algorithms.

7. What is an example of a certain event in probability?

Ans. The occurrence of sunrise and sunset each day is a certain event with a probability of 1.

8. Find the probability of getting two heads when five coins are tossed?

Ans. Number of outcomes of getting two heads = 5 × 2 = 10

Total number of Outcomes = 2 × 2 × 2 × 2 × 2 = 32

$$P(\text{two heads}) = \frac{10}{32} = \frac{5}{16}$$

B. Long answer type questions.

1. What are the possible ways to express probability?

Ans Probability can be expressed in the following ways:

- **Certain events:** An event will happen without a doubt.
- **Likely events:** The probability of one event is higher than the probability of another event.
- **Unlikely events:** One event is less likely to happen than another event.
- **Impossible events:** There's no chance of an event happening.
- **Equal Probability events:** Chances of each event happening is the same.

2. List down the areas of applications of statistics.

Ans. The following are the areas of applications of statistics:

- Sports
- Education
- Disaster management
- Weather forecast
- Disease prediction
- Opinion of voters

3. In the upcoming elections, the election commissioner wants to know whether it will be a hung parliament or a party will have a clear majority. Can this be achieved using statistics? How?

Ans. Yes, it can be achieved. By surveying a group of voters and analysing the results, statistics can reveal what the majority of people think about political candidates, policies, or upcoming elections. This helps politicians and decision-makers understand public opinion.

4. How is probability helpful for a student in studying a specific topic?

Ans.
- Students can use probability to estimate the likelihood of achieving certain grades based on their past performance and study habits.
- By analysing the probability of different outcomes, students can prioritise their study time more effectively.
- If a topic has a high probability of appearing on an exam, students can prioritise their study efforts accordingly.

5. How can probability help in the field of medicine?

Ans.
- Probability helps in understanding how diseases spread and how well treatments work. For example, by estimating the chance of disease transmission in different situations, we can better plan public health measures.
- Probability is used to determine the effectiveness of new treatments or drugs. For example, researchers calculate the probability that observed treatment effects are due to the drug rather than random chance.

C. Competency-based/Application-based questions:

#Problem Solving & Logical Reasoning

1. Nikhil wants to understand customer satisfaction and collects data through feedback forms where customers rate their satisfaction on a scale from 1 to 10. What steps should Nikhil take to explore and clean the customer satisfaction data?

Ans. Nikhil should look first at the data to find patterns, like the range of study hours and grades. He also cleans the data by fixing any missing or incorrect information (e.g., if some students didn't fill in all the fields or gave unrealistic answers).

2. A school is organising a raffle where there are 10 tickets, and only one ticket is a winner. Each student gets one ticket. What is the probability that a specific student wins the raffle?

Ans. Number of Favourable Outcomes = 1 (the winning ticket)

Total Number of Possible Outcomes = 10 (total tickets)

Probability P(A) = $\frac{1}{10}$ = 0.1 or 10%.

Assertion and Reasoning Question:

Direction: Question 3, consist of two statements – Assertion (A) and Reasoning (R). Answer these questions selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true

3. **Assertion (A):** Increasing the sample size generally leads to a more accurate estimation of probabilities.

   Reasoning (R): Larger sample sizes reduce the impact of random variability, leading to more stable and reliable probability estimates.

Ans. a

Unsolved Questions

SECTION A (Objective Type Questions)

AI Quiz

A. Tick (✓) the correct option.

1. ..... are used in concepts like expert systems, database systems and knowledge graphs.

   a. Math ○ b. Logic and set theory ○

   c. Graph theory ○ d. Calculus ○

2. In an ..... event, there's no chance of an event happening.

   a. unlikely ○ b. certain ○

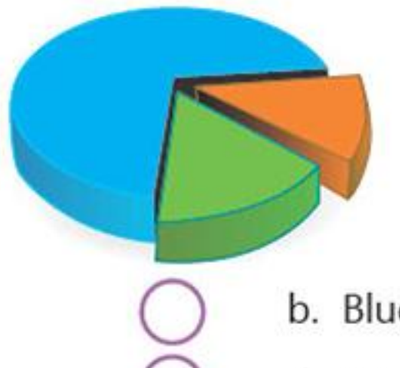
   c. impossible ○ d. likely ○

3. If an event will never happen or is impossible, it will have a probability of ..... .

   a. 1 ○ b. 0 ○

   c. >1 ○ d. <1 ○

4. If you throw an arrow to this pie chart, in which colour is the arrow more likely to fall on? [CBSE Handbook]



   a. Red ○ b. Blue ○

   c. Orange ○ d. Green ○

5. If you select a balloon from a bag having equal number of red, green and yellow balloons, how likely is it that you pick up a blue balloon? [CBSE Handbook]

   a. Probable ○ b. Certain ○

   c. Unlikely ○ d. Impossible ○

6. With one throw of a 6-sided die, what's the probability of getting an even number? [CBSE Handbook]

   a. 1/5 ◯ b. 2/5 ◯

   c. 5/6 ◯ d. 1/2 ◯

7. Time consistently moves forward, and each passing moment is ..... .

   a. uncertain ◯ b. likely ◯

   c. certain ◯ d. unlikely ◯

8. GPT-3, released by OpenAI in 2020, has 175 billion parameters and uses ..... sampling techniques for text generation.

   a. data ◯ b. probabilistic ◯

   c. statistical ◯ d. pattern ◯

B. Fill in the blanks.

1. ..... can see patterns in different types of data.
2. ..... compare the weather conditions with the information about past seasons and conditions.
3. In ..... events chances of each event happening is same.
4. The probability that you can pick a red ball from a bag containing only blue balls is ..... .
5. During games, coaches use ..... models to make strategic decisions.
6. If someone asks you to guess a number between 1 and 10, each number has an ..... probability of being selected.
7. ..... helps us make predictions about future events based on the data we have.
8. ..... can be used to analyse data to create epidemic curves that show the progression of disease outbreaks over time.

C. State whether the following statement is true or false.

1. Data is explored and cleaned to be used. .....
2. Getting seven in die thrown is a possible event. .....
3. Probability can be used in estimating batting average in cricket. .....
4. Statistics can only be used in the mathematical field because of its ability to extract meaningful insights from data and assist in decision making. .....
5. Analysis of data is done to understand it better. .....
6. Linear algebra is involved in small data processing. .....
7. Understanding math will help us to better understand AI and its way of working. .....
8. The design of the algorithms often uses scientific derivations. .....

SECTION B (Subjective Type Questions)

A. Short answer type questions.

1. How is mathematics and AI related? Explain in short.
2. What are patterns? Explain with examples.
3. What is meant by equal probability events?
4. What is the role of "Collecting Data" in statistics?
5. Give any two applications of statistics in real life.
6. If you have 10 red dresses and 3 white dresses. What is the probability of wearing white dress?
7. Give one use of statistics in disaster management.
8. Give one use of probability in finance.

B. Long answer type questions.

1. "Statistics is used for collecting, exploring, and analysing the data." Elaborate with the help of an example.
2. List any three uses of statistics in education.
3. Explain the concept of probability with the help of an example of a deck of 52 cards.
4. When discussing probability, we often rely on specific terms to describe the likelihood of events occurring. Explain any one likelihood of an event with examples.
5. What role does probability play in estimating the traffic on the road? List any three with examples.
6. Identify the likely, unlikely, impossible and equal probability events from the following with proper explanation:
   a. Tossing a coin
   b. Rolling an 8 on a standard die
   c. Throwing ten 5's in a row
   d. Drawing a card of any suite
7. Write any two examples of impossible and equal probability events.
8. Define certain events and likely events with examples.

C. Competency-based/Application-based questions:

#Problem Solving & Logical Reasoning

1. Imagine a student preparing for a math exam that covers five topics. Based on past exams and the instructor's hints, the student estimates the probability of each topic appearing on the exam as follows:

   Topic A: 0.8

   Topic B: 0.6

   Topic C: 0.4

   Topic D: 0.7

   Topic E: 0.5

   How will this help him in preparing for the exam to score good marks?
2. Let's say a company wants to launch a new product—a smartphone—into the market. Before launching the product, the company conducts market research to understand consumer preferences and potential demand for the new smartphone. What role will the statistics play in smoothening this process?
3. Predicting earthquakes with precise accuracy is incredibly challenging due to the complex nature of seismic activity. However, probability can still play an important role in this. Can you find a few of the important applications of probability in predicting earthquakes?
4. Aman is confused, how probability theory is utilised in artificial intelligence, help Aman by providing two examples to illustrate its importance.

Ai In Life

#Experiential Learning

Students are introduced to the concept of probability at a very early stage of life, it begins with a real life situation. For example, flip a coin and ask what the chances are that it will come out heads. Or, place the coin in one hand, and put both hands behind your back. Ask one student to guess which hand it is in.

Discuss your findings with your classmates, and illustrate some more examples from real life.

Ai Deep Thinking

#Creativity & Innovativeness

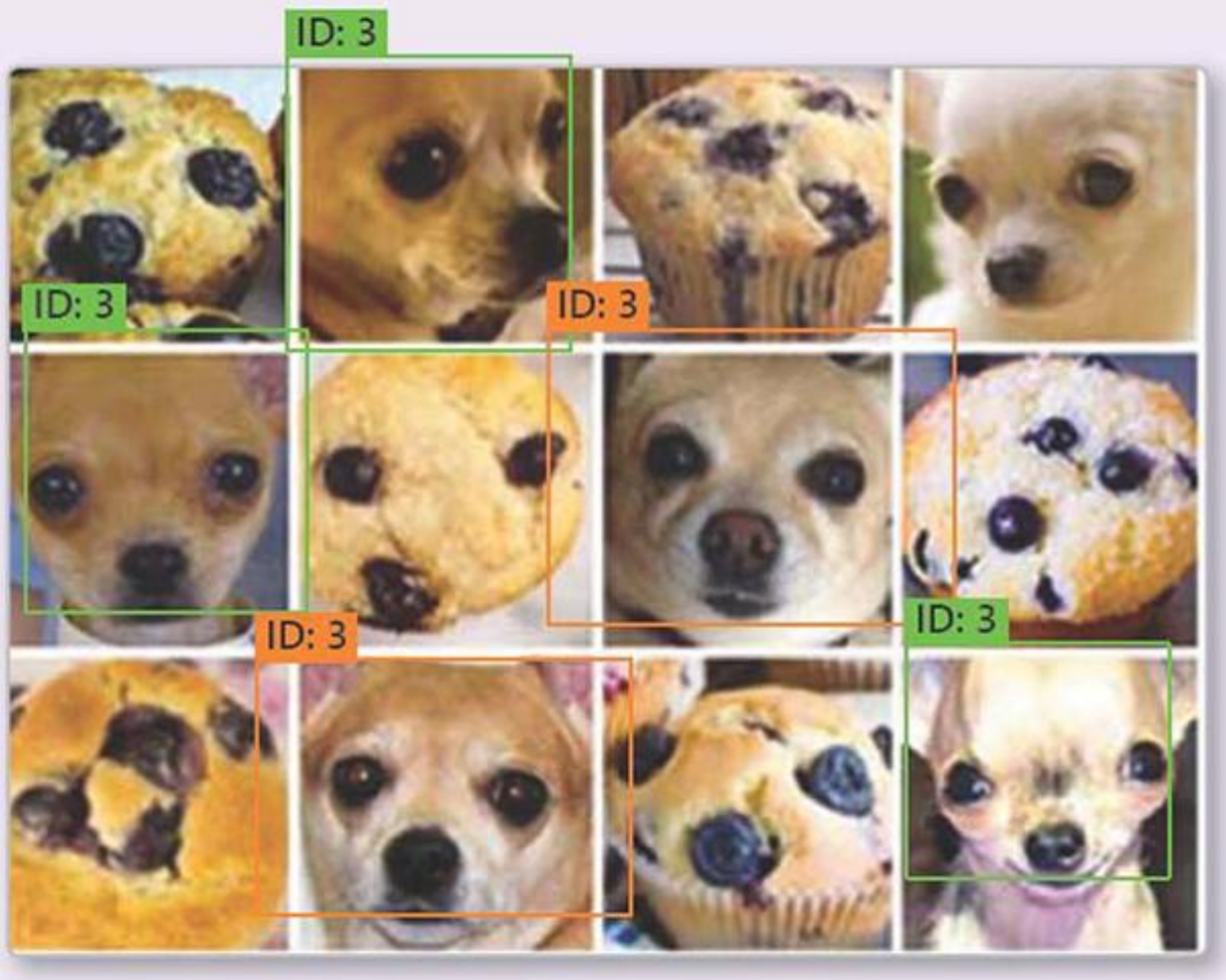
The adoption of AI in healthcare could save between 5% to 10%. AI in healthcare statistics shows that 90% of nursing tasks will still be performed by humans in 2030.

Considering the above facts, create a report on which all tasks of nurse shall be taken over by AI.

Class Activity

#Problem Solving & Logical Reasoning

1. Identify Dogs [CBSE Handbook]



ID: 0

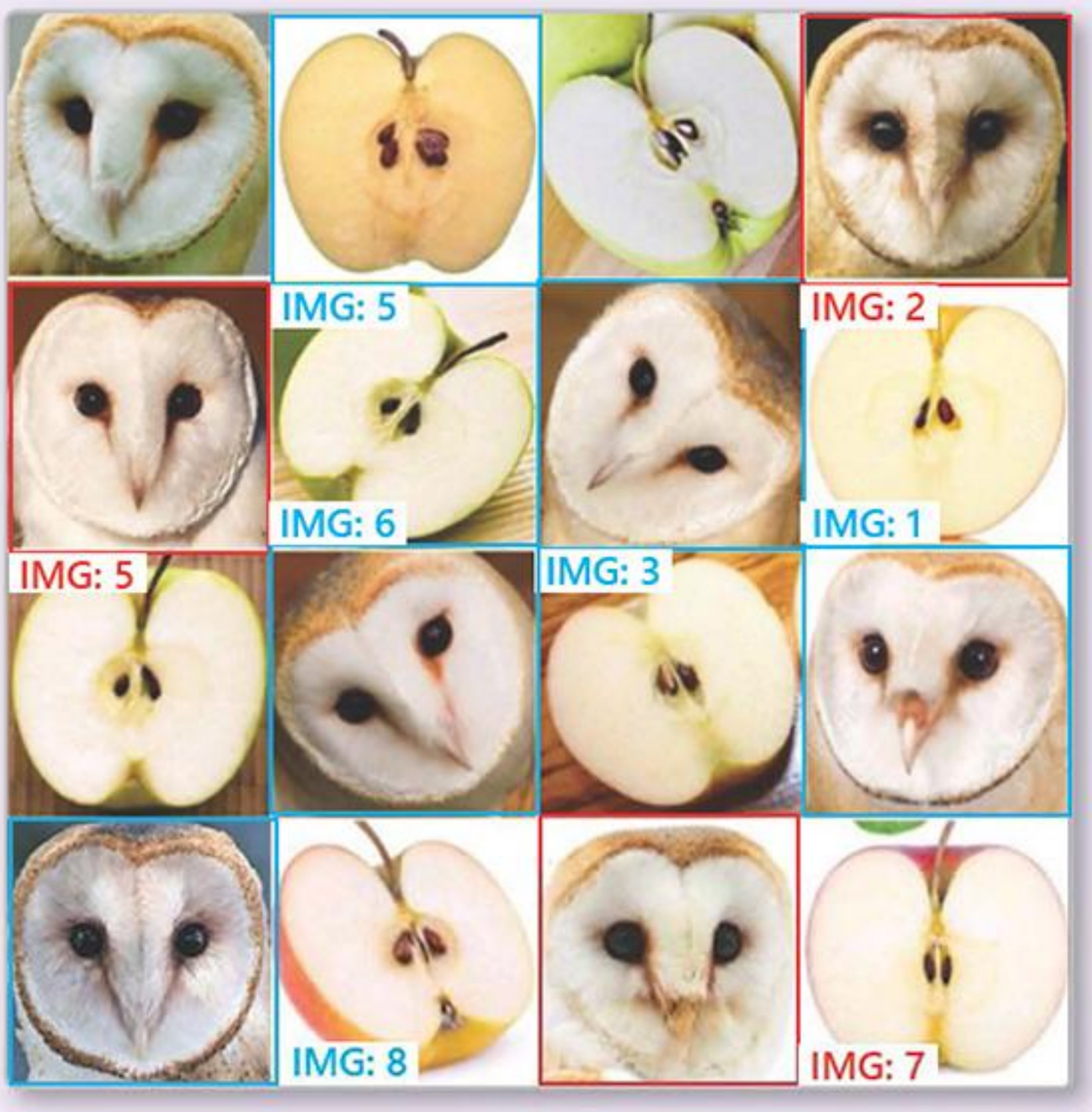
Type: Dog

Breed: Chihuahua (41.0%)

Emotion: Scared (98.0%)

Scared (98.0%), Angry (2.0%), Happy (0.0%), Neutral (0.0%), Sad (0.0%)

2. Identify Owl from Apples



#Experiential Learning

Type: Owl

Breed: Barn

Active: 100% (Awake) 0% (Sleeping)

Takeaways from the above activity

- Just like we can recognise patterns in numbers, words, pictures, etc. AI can also recognise similar patterns.
- AI is a way to recognise patterns in order to make decisions.
- AI needs Math to study and recognise patterns in order to take decisions.

3. Can you identify any pattern in the image given below? [CBSE Handbook]

$1 \times 9 + 2 = 11$

$12 \times 9 + 3 = 111$

$123 \times 9 + 4 = 1111$

$1234 \times 9 + 5 = 11111$

$12345 \times 9 + 6 = 111111$

$123456 \times 9 + 7 = 1111111$

$123457 \times 9 + 8 = 11111111$

$12345678 \times 9 + 9 = 11111111$

$123456789 \times 9 + 10 = 111111111$

1

1 1

1 2 1

1 3 3 1

1 4 6 4 1

1 5 10 10 5 1

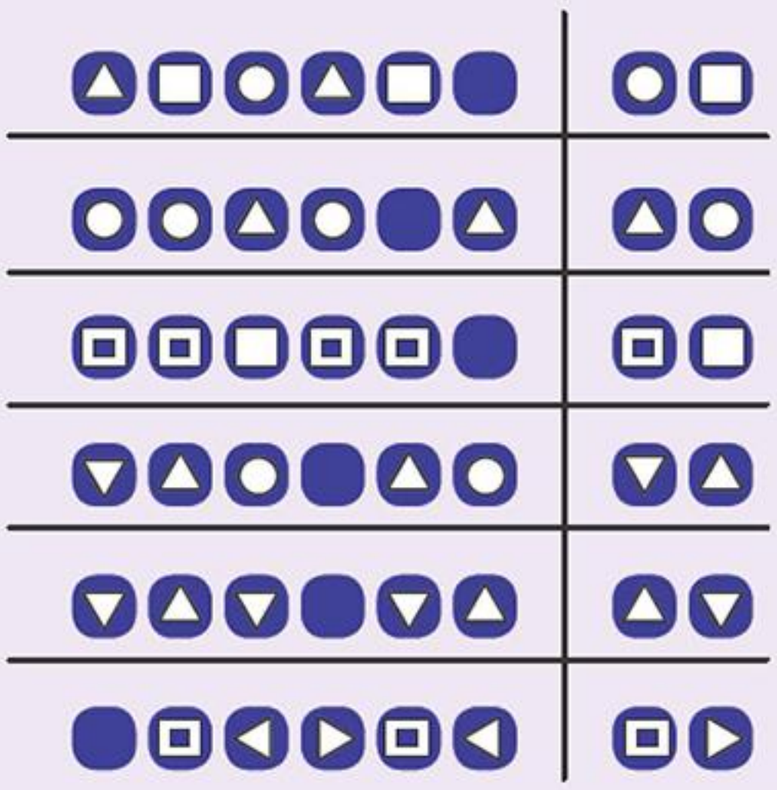
1 6 15 20 15 6 1

1 7 21 35 35 21 7 1

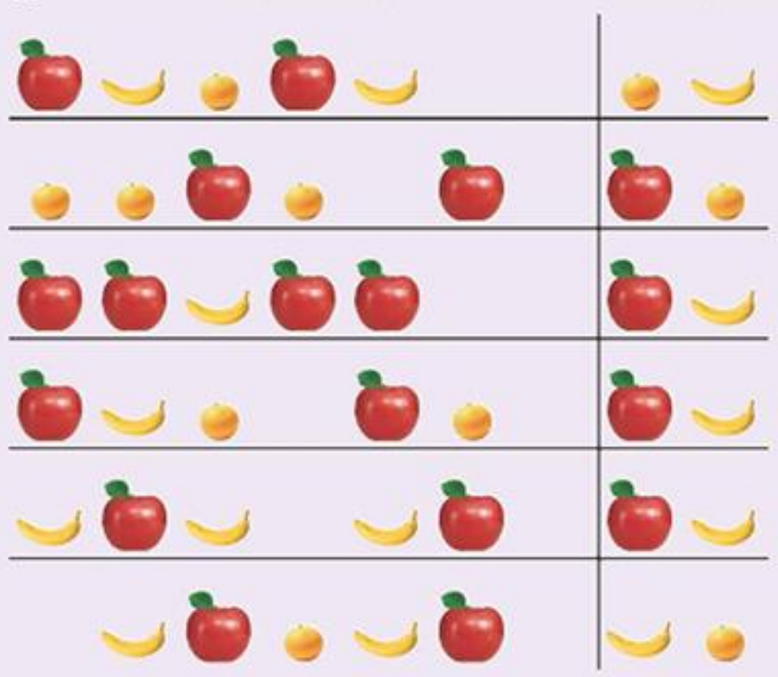
4. Find connections between sets of images and use that to solve problems, think smartly, and grasp tricky ideas.

Complete the sequence in the left column by identifying the correct missing piece in the right column out of the given options. [CBSE Handbook]

i.



ii.



Data Collection

- Visit the following link:
  https://www.youtube.com/watch?v=4A5L3x3TVuc&ab_channel=CarvingCanyons
- Fill the table while watching the video using tally.

Car Colour	Number of Cars spotted
Red	
Black	
White	

Use the given Reference Tally to maintain the count of each

1	I	6	𝍸 I
2	II	7	𝍸 II
3	III	8	𝍸 III
4	IIII	9	𝍸 IIII
5	𝍸	10	𝍸 𝍸

Answer the following questions based on the table filled above:

Data Analysis

How many cars are spotted in total?

Which colour has been spotted the maximum amount of time?

Data Interpretation

What is the most common colour choice for the residents of this area?

Answers

Exercise (Section A)

A. 1. a 2. d 3. a 4. a 5. c 6. b 7. c 8. a

B. 1. Artificial Intelligence 2. Graph theory 3. Statistics 4. Probability
5. Unlikely 6. one 7. Probability 8. Fibonacci series

C. 1. True 2. False 3. True 4. True 5. False 6. False 7. True 8. True

Answer the following questions:

1. Explain one example in your day to day life where you think that AI and Maths play a vital role.

2. When you order food online, you receive a link for the feedback. Based on the questions asked by the chatbot, you are able to give your feedback. What is the probability of the feedback shared by you is not altered by chatbot?

3. How is probability affecting the weather forecast system?

UNIT-4

INTRODUCTION TO GENERATIVE AI

Learning Outcomes

- Real Images vs AI-Generated Images
- Supervised Learning and Discriminative Modelling
- What is Generative AI?
- Examples of Generative AI
- Generative AI Tools
- The Potential Negative Impact on Society
- AI or Real Image....How to Identify?
- Unsupervised Learning and Generative Modelling
- Types of Generative AI
- Generative AI Boon or Bane
- Ethical Considerations of using Generative AI
- Responsible Use of Generative AI

The simpler it is to understand the context through visualisation (images), the more difficult it is to identify, whether the image is real or artificial. Today, 50% of the images we see online are a result of Generative Artificial Intelligence (Gen AI).

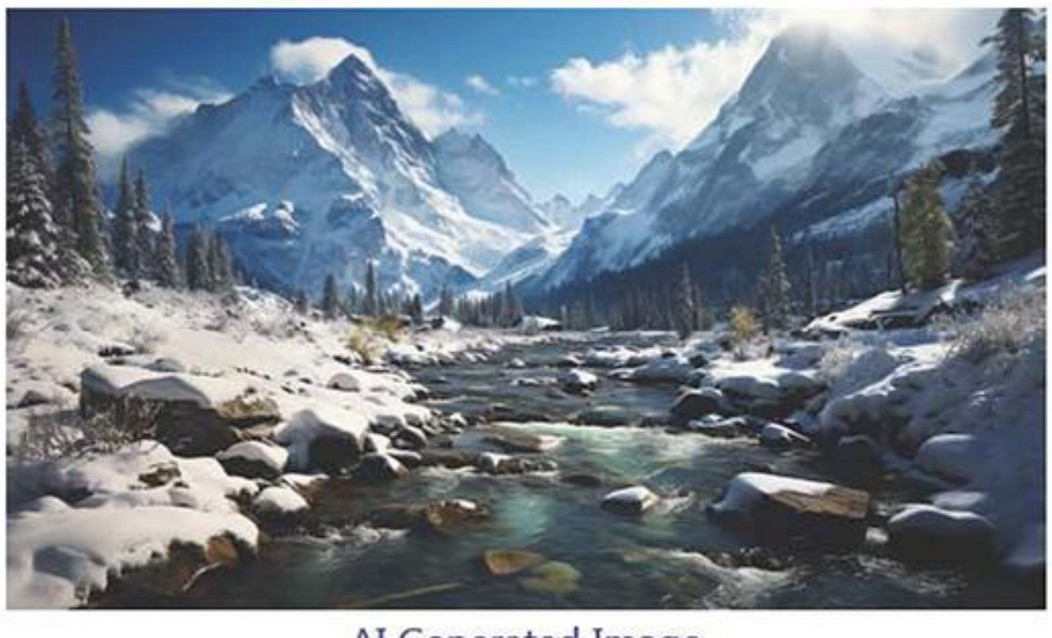
Let us learn more about it.

Real Images vs AI-Generated Images

Real images are captured by cameras, they are visual representations depicting scenes, objects, or people in the same way as they exist in the real world. They are created on the same side of the lens or mirror as the viewer. These images are either created by or clicked by humans.

AI-generated images are created using AI algorithms. These algorithms use large amount of data and learn patterns to create new images that look like real ones. Sometimes AI incorporates small details that don't exist in the original picture to enhance the look of the scene. AI can create images that can be modified and enhanced. It can also create entirely new, imaginative images.

Real Image



AI Generated Image

Ai Task

#Problem Solving & Logical Reasoning

Examine the images marked as Image 1 and Image 2 and determine whether the image is a real image or an AI-generated image. Also, give reasons for your answer.

Image 1	Image 2
1. _____	a. _____
2. _____	b. _____
3. _____	c. _____

Image 1	Image 2
4. _____	d. _____
5. _____	e. _____

Brainy Fact

Companies like OpenAI, Google, Facebook, and NVIDIA have invested heavily in research and development of generative AI technologies.

AI or Real Image....How to Identify?

Distinguishing between a real image and one generated by AI can be challenging as AI-generated images continue to become more sophisticated. However, there are a few indicators you can look for:

- Artificial intelligence shows inconsistencies if observed closely, although it tries to piece together its creations from the original work. The artefacts can include unnatural blurriness, inconsistent lighting/shadowing, or repeating patterns, specially in the backgrounds.
- AI-generated images may include elements that seem unrealistic or improbable, such as impossible perspectives, mismatched colours, or objects that defy physics, making the image appear unnatural or inconsistent with the scene.
- Odd outlines to sharpen or smoothen the edges, stray pixels to cover inconsistency, and abnormal shapes can be easily seen, if an image is zoomed to the maximum, on each of its parts.

Let's look at the concepts behind the generation of these images.

Supervised Learning and Discriminative Modelling

Supervised Learning is a type of Machine Learning where we teach models using examples that have labels. It uses labelled datasets to train algorithms to predict outcomes and recognise patterns.

These labels tell the model the correct answer for each example. Discriminative Modelling is a special kind of supervised learning that focuses on learning how to distinguish different classes. It looks at the features of the data to figure out which class it belongs to.

Supervised Learning

Supervised learning is a machine learning where a model is trained on a labelled dataset, implying that each input data point is associated with a corresponding output label. The goal of supervised learning is to learn the mapping between input data and output labels, enabling the model to make predictions on new, unseen data.

Supervised learning is when we train the machine using labelled data. The machine is provided with a new set of labelled data so that the supervised learning algorithm analyses the training data and generates the most suitable and related outcome from the trained-labelled data. Labeled data contains data with the correct output or classification. In simple words, input data is paired with the desired output thus making the machine learn to predict the output for new input data.

For example, in the given images, first is the input image and characteristics of this image are marked as boy and ball, which can be seen in center image. Now, according to supervised learning it has to learn the mapping between input labels and output labels, which is shown in last image and highlights "ball" as red, "boy" as purple and "boy playing with a ball" in a rectangle.

Input	Features of given image	Output Label for the item
	 Boy Ball	 Boy playing with a ball

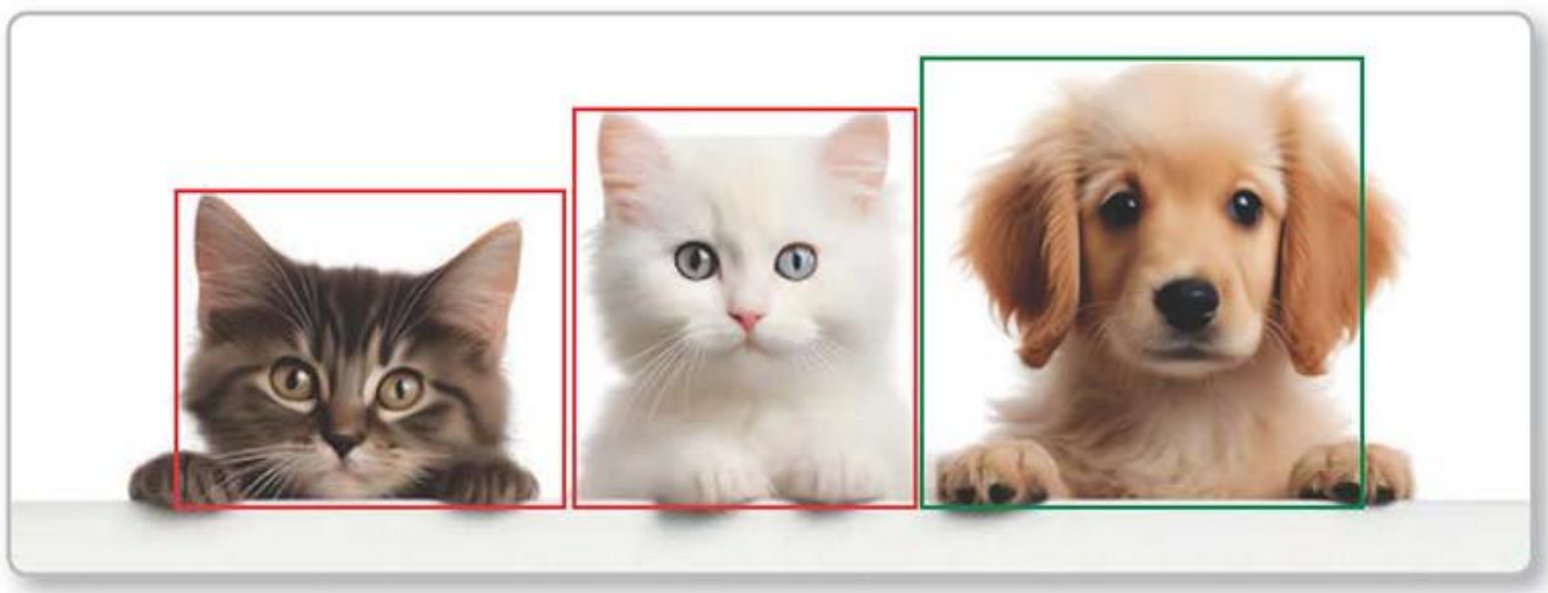
In a supervised learning model, a labelled dataset is given to the machine. A labelled dataset is the information which is tagged with identifiers of data. For example, clothes in a store are marked under various categories of clothing like Shirts, Trousers, Coats, etc. They are further labelled as per gender and size.

Discriminative Modelling

Discriminative modelling is an approach in machine learning where the focus is on learning the boundary or decision boundary that separates different classes or categories directly from the data. So, if an image contains a combination of Dogs and Cats, the model is able to tell which is a Dog and which is a Cat.

Input Image

Output



Cats = 2 Dog = 1

In supervised learning, discriminative modelling contrasts with generative modelling, where the goal is to model the joint probability distribution of both the input features and the output labels. Generative models can be used to generate new data points that resemble the training data, whereas discriminative models are primarily focused on classification or regression tasks.

Let us consider an example.

A father has two kids, Kid A and Kid B. Kid A has a special learning ability where he can learn everything in depth. Kid B has a special learning ability where he can only learn the differences between what he saw.

One fine day, the father shows his kids (Kid A and Kid B) two kinds of animals, a dog and a cat. After a few days, the father showed them an animal and asked both of them "Is this animal a dog or a cat?"

Kid A drew the image of a dog and a cat on a piece of paper based on what he saw earlier. He compared both the images with the animal standing before him and answered based on the closest match of the image and animal, he answered: "The animal is a dog." Kid B knows only the differences, based on different properties learned, he answered: "The animal is a dog."

Here, we can see both of them are finding the kind of animal, but the way of learning and the way of finding the answer is entirely different. In machine learning, we generally call Kid A as a generative model & Kid B as a discriminative model.

A discriminative model models the decision boundary between the classes. A generative model explicitly models the actual distribution of each class. In final both of them is predicting the conditional probability P (Animal Features). But both models learn different probabilities.

Unsupervised Learning and Generative Modelling

Unsupervised learning is a type of machine learning where models are trained using data that does not have labels. This means the model has to find patterns and relationships in the data on its own. Generative modelling is a specific approach within unsupervised learning that focuses on understanding and modelling how the data is generated. Generative models try to learn the underlying rules that produce the data, so they can create new examples that look similar to the original data. In summary, Unsupervised learning is about finding patterns in unlabelled data, and generative modelling is a method within this type of learning that aims to understand and replicate how the data is made.

Unsupervised Learning

Input Unstructured/Unlabelled dataset	**Output** Emergent pattern/inherent structure	Example that's similar to what's in the dataset

The goal of unsupervised learning is to find patterns, structures, or representations in the data without human intervention. An unsupervised learning approach works on an unlabelled dataset. This means that the data which is fed to the machine is random and there is no know-how available about it to the trainer.

Ai Reboot

1. Differentiate between Supervised Learning and Unsupervised Learning approach.

   _____

   _____

2. List any two points to differentiate between real and AI-generated images.

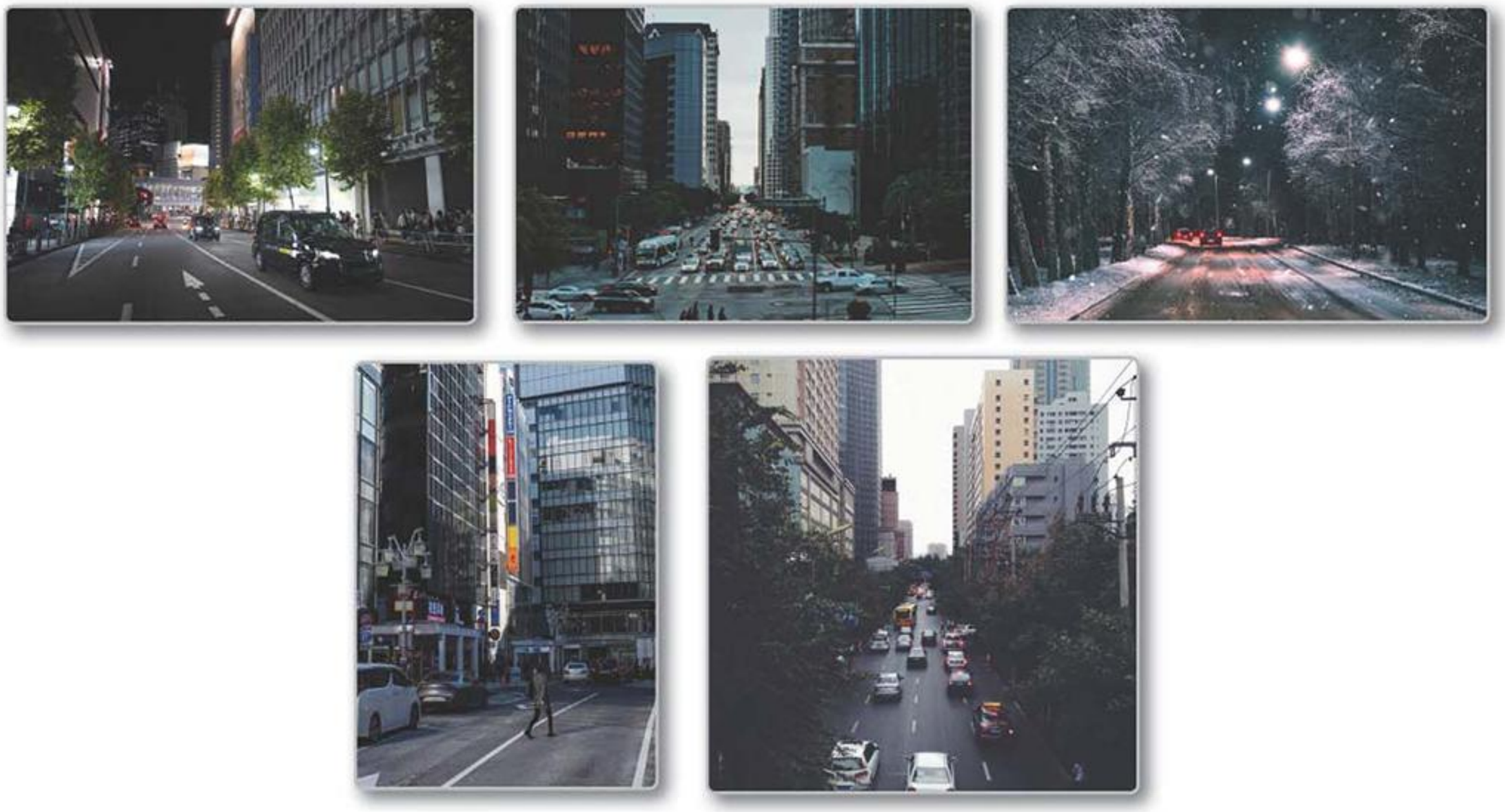
   _____

   _____

Generative Modelling

Generative Modelling do not necessarily require labelled datasets. It can work with unlabelled data to learn the underlying distribution of the data and can **generate structured data from the random noise dataset**. So, if random images are fed as training data for the model it can create relevant output based on the features of the input data. If there are random images which depict streets, cars, buildings, sky, etc. In a given dataset of street images, a Generative Modelling can learn to generate new street scenes that look like the ones in the dataset. In another example, if given a dataset of news articles, a generative model can learn to generate new articles that resemble the style and content of the training data. Let us take an example.

The following images are given as input to the Generative AI model:

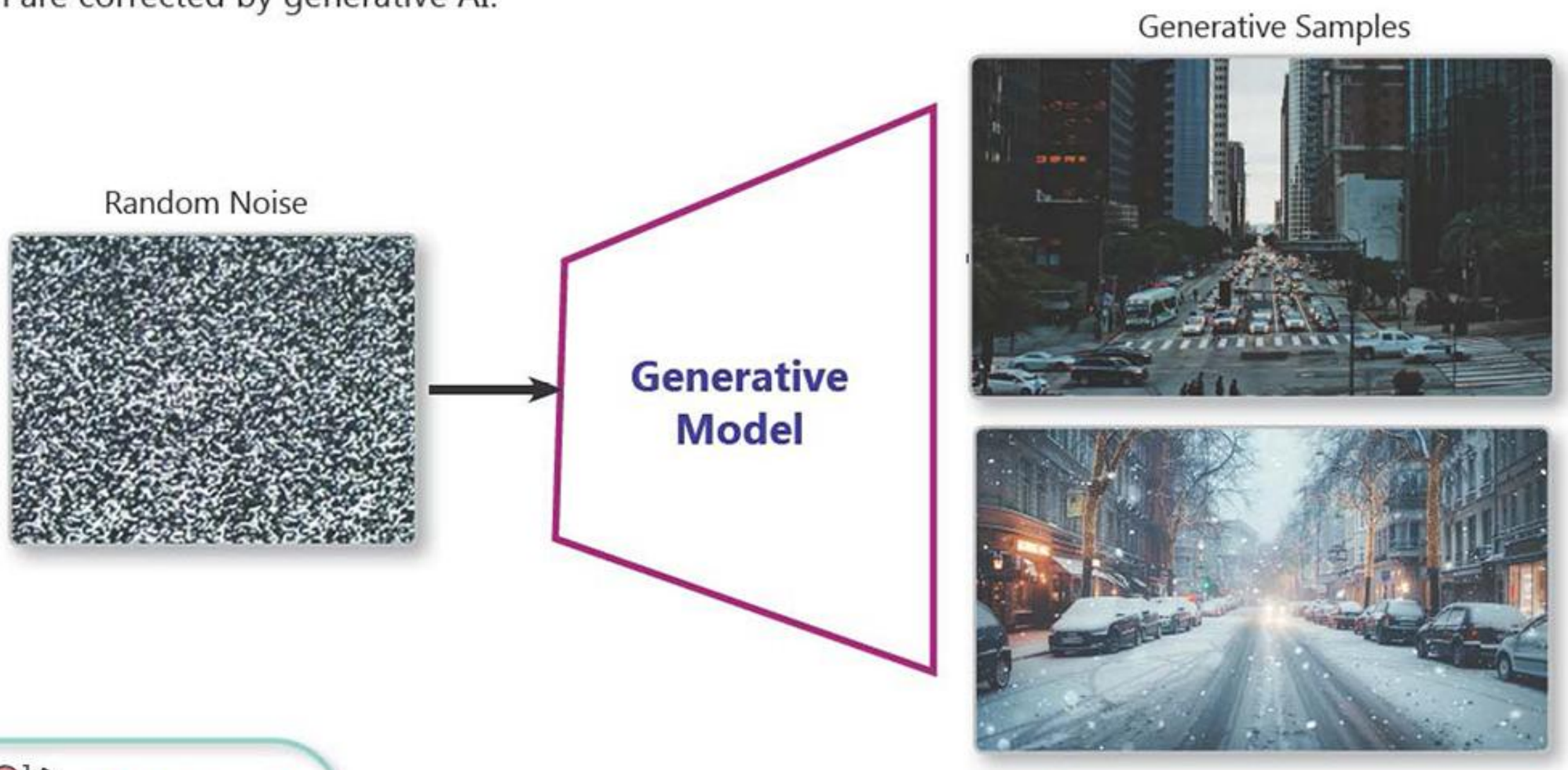


The output produced based on input images by generative AI are as follows:

The Generative AI model takes the input and can recreate its own set of objects in the image, which may or may not exist in reality.

Random Noise Dataset

A "random noise dataset" typically refers to a collection of data points or samples where each data point is generated randomly. There are unpredictable fluctuations and disorganised data, which makes it impossible to identify target patterns or relationships in it. This may result in decreased accuracy or reliability of the output, which are corrected by generative AI.



Ai Task

#Problem Solving & Logical Reasoning

Based on your learning so far, identify the real and AI generated image among the given set of images. Also state any three reasons for the same.

Ai Reboot

What is "Random Noise" dataset? Give an example of it from life around you.

What is Generative AI?

Generative Artificial Intelligence (AI), also known as Gen AI, encompasses algorithms designed to produce new data closely resembling human-generated content across various forms, including audio, code, images, text, simulations, and videos. Leveraging existing data and content for training, Generative AI holds promise for applications spanning natural language processing, computer vision, the metaverse, and speech synthesis. As it undergoes continuous training with more data, this technology evolves, progressively refining its capabilities. Its growing popularity stems from the intuitive interaction it enables, allowing users to prompt the AI using natural language. Notably, the output generated by generative AI often achieves a level of quality indistinguishable from human creation. Within Generative AI, a "prompt" serves as the initial input or instruction guiding the AI model in generating desired content. For instance, in a text generation model, a prompt may consist of a sentence or keywords, while in an image generation model, it could entail a description of the desired image.

#Experiential Learning

Video Session

Scan the QR code or visit the following link to watch the video:

https://www.youtube.com/watch?v=26fJ_ADteHo

This video gives you a clear picture of generative AI. Now answer the following questions:

1. What is your understanding of generative AI?

2. Give two examples of generative AI.

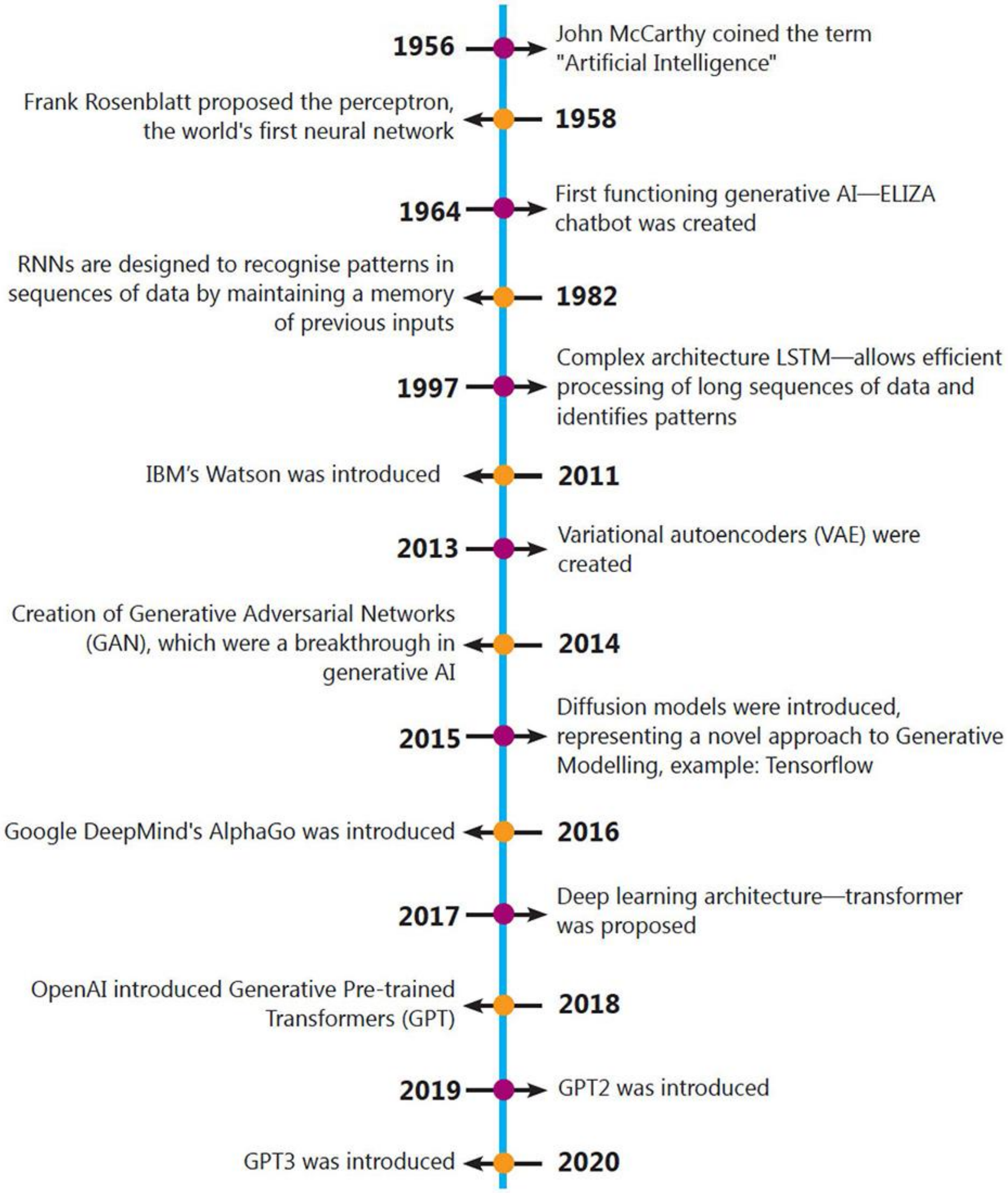
Brainy Fact

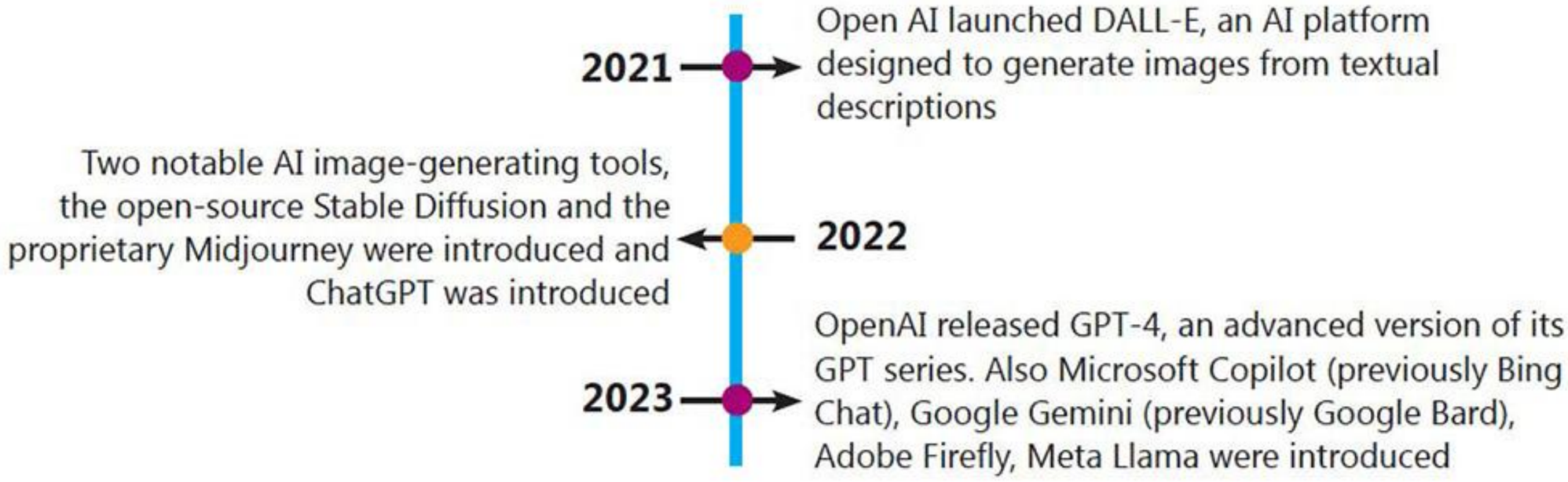
Generative AI is now part of the workforce in the US, UK, Australia, and many other parts of the world.

Timeline of Generative AI

Generative AI has been getting better and better over the years. Scientists have been working hard to improve the technology using things like neural networks and deep learning. They've been trying out different ideas and making big discoveries in how to make it work better. Now, Generative AI can do lots of cool stuff like writing text, making pictures, and creating new things. It's been a long process of learning and making things better, but now we can see all the amazing things it can do!

Timeline of Generative AI:





Generative AI vs Conventional AI

Generative AI and Conventional AI represent two different approaches in the field of artificial intelligence. The difference between them is given in the following table:

	Generative AI	Conventional AI
Goal	Generative AI creates new content that mimics the original content. This content includes images, text, music, or other forms of media.	Conventional AI analyses, processes, and classifies data. It works to improve the accuracy, precision, recall, and speed within the scope of the defined task.
Training	Generative AI models are often trained using techniques such as generative adversarial networks (GANs), variational autoencoders (VAEs), or autoregressive models.	Conventional AI models are typically trained using supervised, unsupervised, or reinforcement learning techniques.
Dataset	Generative AI models typically require large amounts of diverse and representative data to learn effectively. These datasets often contain thousands or even millions of examples across various categories or classes.	Conventional AI models rely on smaller, more curated datasets that are tailored to the task at hand.
Output	Generative AI output is fresh, innovative, and often unexpected.	Conventional AI produces more predictable output based on existing data.
Applications	Generative AI is used in the fields of art, music, literature, gaming, and design.	Conventional AI is used in banking, healthcare, image recognition, and language processing.

Types of Generative AI

Generative AI comes in a variety of forms, each with unique advantages and uses. Some of the most typical varieties are as follows:

- Generative Adversarial Networks (GANs)
- Variational Autoencoders (VAEs)
- Recurrent Neural Networks (RNNs)
- Autoencoders (AEs)

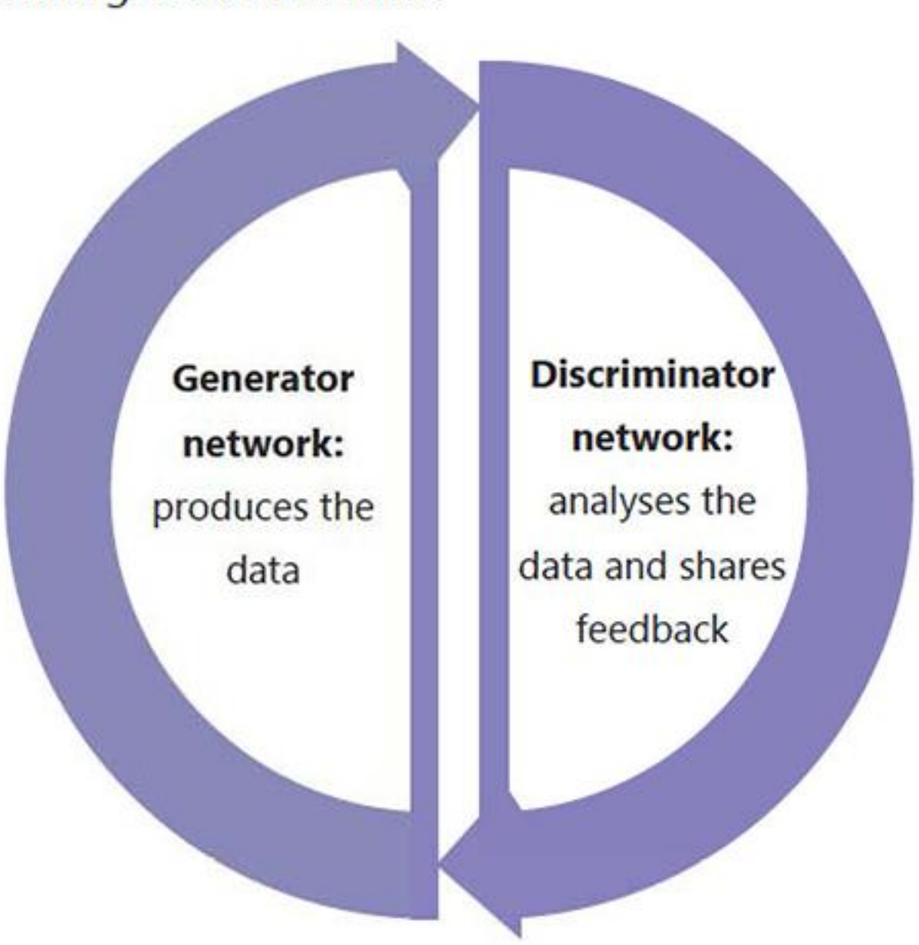
Let's study about them in detail.

Generative Adversarial Networks (GANs)

GANs are neural networks that work to produce fresh data. It is made up of two neural networks, which work together in a unique adversarial process to create realistic synthetic data. These two neural networks are as follows:

- **Generator Network:** It produces data that is as close as possible to real data.
- **Discriminator Network:** It analyses data and provides feedback, i.e. it takes real data and the data generated by the generator as input and attempts to distinguish between the two.

These two networks work together in a cycle where the generator tries to create realistic fake data, and the discriminator tries to identify whether the data is real or fake. This back-and-forth process helps the generator improve and produce more convincing data over time.

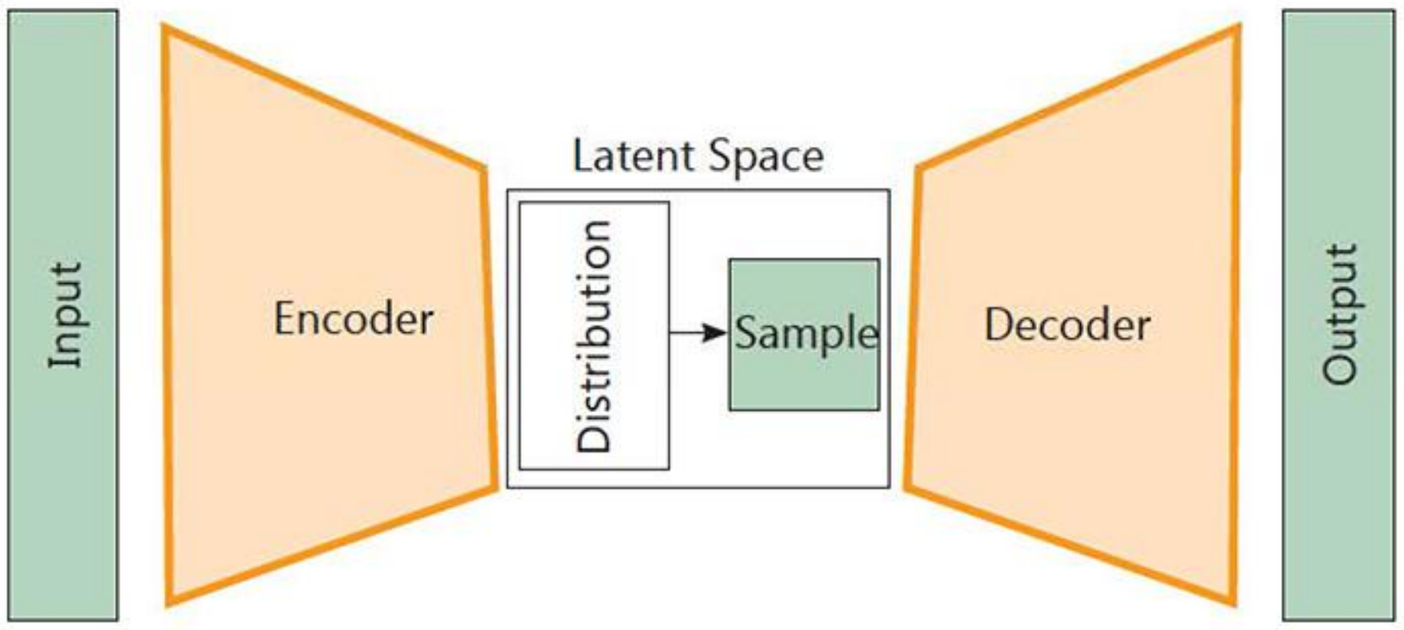


Some of the examples of GANs are as follows:

- It can create portraits of non-existing people.
- It can convert images from day to night.
- It can generate images based on textual description, for example, if we give a description of a bird, then it will create an image that is similar to the description.
- It can generate realistic video, which can be used in film production, video games, and generating synthetic data for training other AI models, etc.

Variational Autoencoders (VAEs)

A variational autoencoder (VAE) is a Generative AI algorithm that uses deep learning to generate new content, detect anomalies, and remove noise. This is another class of generative models. To produce fresh data, VAEs learn the distribution of the data and then sample from it.

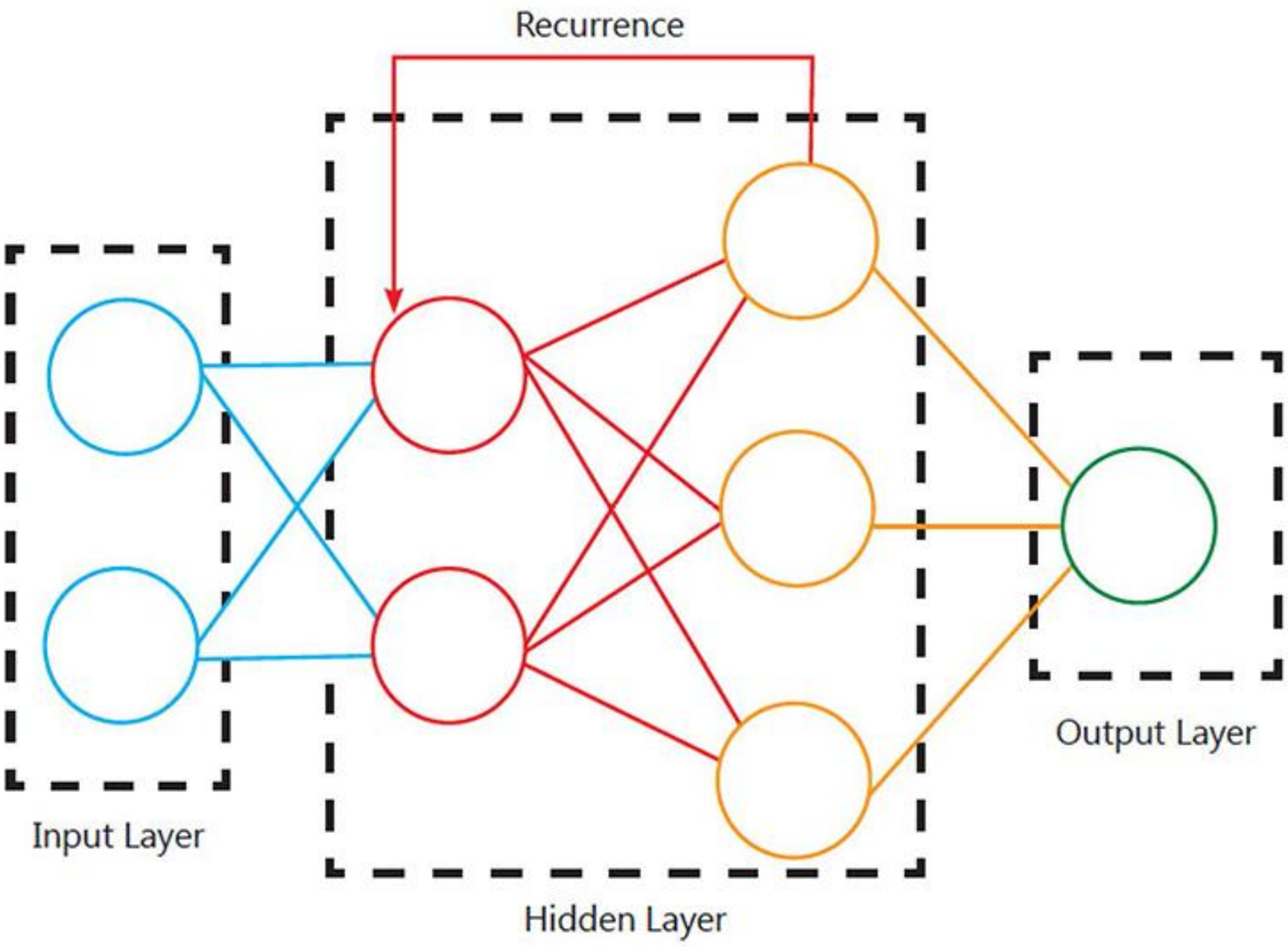


Some of the examples of VAEs are as follows:

- It can generate new images like the given training set. For instance, a VAE trained on images of faces can generate new, realistic-looking faces.
- It can produce new text that follows the same style and structure as the training data, assisting writers with drafts and ideas.
- It can be used for composing new music pieces or creating sound effects, music composition, etc.

Recurrent Neural Networks (RNNs)

RNNs are a special class of neural networks that excel at handling sequential data, like music or text. They excel at tasks where the order of the data points is important, as they can remember previous inputs and use this information to influence current outputs.

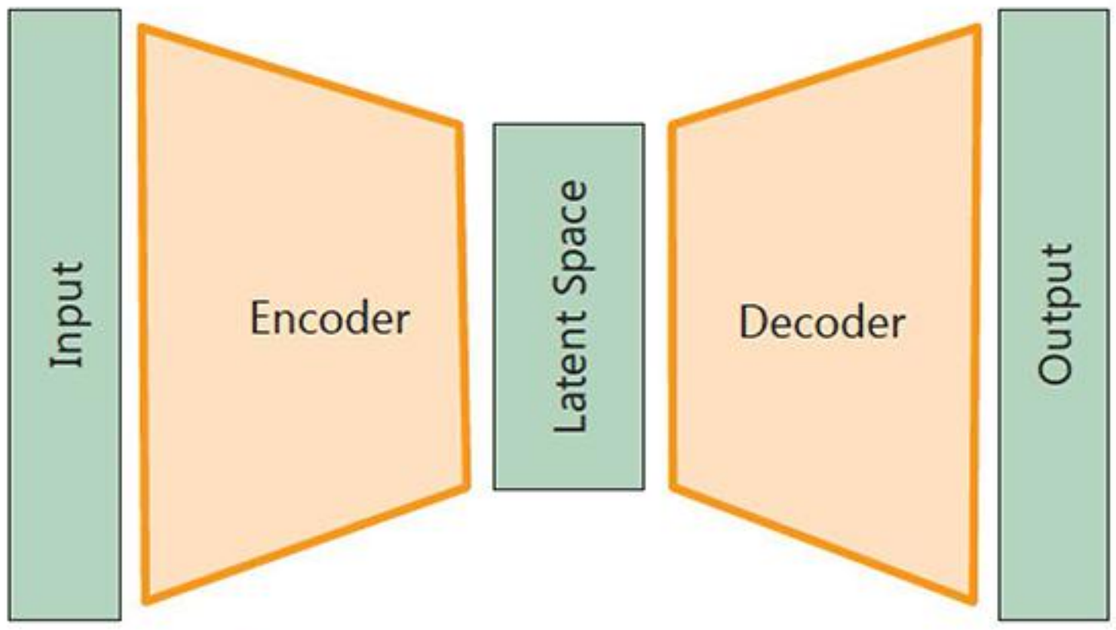


Some of the examples of RNNs are as follows:

- It can generate novel text in the style of a specific author or genre, like creating new sentences that mimic the style of Shakespeare or generating dialogue for a chatbot.
- It can predict the next character or word in a sequence, like autocomplete features in text editors and predictive text input on smartphones.
- It can be used to predict future values in a time series, such as stock prices or weather data, by learning patterns from historical data.

Autoencoders (AEs)

These are neural networks that have been trained to learn a compressed representation of data. They work by compressing the data into a lower-dimensional form (encoding) and then decompressing it back to its original form (decoding). This process helps the network learn the most important features of the data.



Some of the examples of AEs are as follows:

- It can help in cleaning up noisy images to produce clear and highly realistic samples.
- It can help in compressing high-resolution images for efficient storage and transmission.
- It can create artistic images based on learned features from famous paintings.
- It can help in drug discovery by learning and generating molecular structures that have desirable properties.

Similarities and Differences between AEs and VAEs

The similarities and differences between Autoencoders (AEs) and Variational Autoencoders (VAEs) are as follows:

Similarities

- Both AE and VAE are neural network architectures that are used for Unsupervised Learning
- Both AE and VAE consist of an encoder and a decoder network. The encoder maps the input data to a latent representation, and decoder maps the latent representation back to the original data.
- Both AE and VAE can be used for tasks such as dimensionality reduction, data generation, and anomaly detection.

Differences

	AE	VAE
Basic Function	Neural network model that learns to encode input data into a compressed representation and then decode it back to the original data.	Similar to AE but incorporates probabilistic elements to learn a latent space representation of input data.

	AE	VAE
Latent Space Representation	Deterministic, fixed-dimensional encoding of input data.	Probabilistic, continuous latent space representation, allowing for sampling of data points.
Reconstruction Loss	Minimises the difference between the input data and its reconstructed output.	Same as AE but also includes a regulariser to enforce a Gaussian-like distribution in the latent space.
Handling Overfitting	Can suffer from overfitting due to the fixed encoding structure.	Less prone to overfitting due to the probabilistic nature of the latent space, which allows for smoother generalisation.
Applications	Image compression, denoising, feature extraction.	Data generation, Unsupervised Learning, anomaly detection.
Training Complexity	Relatively simpler training process.	More complex training process due to the inclusion of regularisation terms and sampling from the latent space.

Examples of Generative AI

Generative AI has many applications, from art and music to language and natural language processing.

Let's study some examples of how Generative AI is being used in various fields.

Art

Generative AI can create new artworks by learning styles from famous painters and generating novel pieces in similar styles. For example:

- AI artists like "AI Portraits" and "DeepArt" have gained popularity for their ability to create visually stunning images.
- The Next Rembrandt project used data analysis and 3D printing to create a new painting in the style of Rembrandt.

Gen AI can be used for style transferring and portrait creation.

Object	Style
Gen AI created an image with a given style	
Style Transferring	

Portrait Creation

#Experiential Learning

Video Session

Scan the QR code or visit the following link to watch the video:

https://www.youtube.com/watch?v=IuygOYZ1Ngo

This video is on The Next Rembrandt. Now, answer the following question:

What are the points to be noted while using generative AI in recreating traditional art?

Music

Generative AI is transforming the music industry by enabling the creation of new music, either through composing original pieces or remixing existing ones.

One prominent example of this innovation is AIVA, an AI composer capable of creating original music in various genres.

Music composition

Music Genre

#Experiential Learning

Video Session

Scan the QR code or visit the following link to watch the video:

https://www.youtube.com/watch?v=wYb3Wimn01s

This video is on How AI could compose a personalised soundtrack to your life | Pierre Barreau. Now, answer the following question:

What is the name of AI composer mentioned in the video?

Language

Generative AI is being used to generate new languages, such as chatbots that can hold conversations with users or natural language generation systems that can produce written content.

Gen AI in Language

Language translation

Text to speech

Data creation

#Experiential Learning

Video Session

Scan the QR code or visit the following link to watch the video:

https://www.youtube.com/watch?v=BWCCPy7Rg-s

This video is on What is ChatGPT, the AI software taking the internet by storm? – BBC News. Now, answer the following question:

ChatGPT is being used by masses, what are the concerns arising because of it?

Generative AI Boon or Bane

Generative AI, a powerful new technology, has both advantages and disadvantages. On one hand, it helps people be more creative, makes complex tasks easier, and sparks new ideas in various fields. Artists and writers can use it to come up with fresh concepts, and ideas, and businesses can work more efficiently. On the other hand, it can cause problems like ethical issues, job loss, and being used for harmful purposes. For example, it can create fake images or spread false information, which can be dangerous. To make the most of Generative AI while avoiding its risks, we need smart rules and careful use. It can be a great tool or a big problem, depending on how we manage it.

Benefits of Using Generative AI

In general, Generative AI brings many good things to the table. It boosts creativity, helping to come up with new and interesting ideas. It also makes things run smoother and faster, saving time and effort. Plus, it tailors things to each person's preferences, making experiences more personal. With Generative AI, businesses and groups can explore new possibilities and reach more people.

It's also easier for everyone to use, making it accessible to a wider audience. And as needs grow, Generative AI can easily adapt and handle bigger tasks. By tapping into these advantages, businesses and organisations can make their content creation processes better and give their users even better experiences.

Some advantages of Generative AI are as follows:

- **Creativity:** Generative AI is a real game-changer when it comes to creativity. It helps artists, designers, and musicians explore new horizons and make their creative work more efficient and personal. Whether it's coming up with fresh and innovative ideas, refining designs, or composing music, Generative AI can lend a hand in making the creative process smoother and more tailored to individual tastes. This is super valuable in fields like art, design, advertising, and music, where pushing the boundaries and expressing unique visions are key.

- **Efficiency:** Generative AI is all about making things easier and quicker. By automating content creation, it saves a lot of time and money compared to doing things manually. Instead of spending hours or even days creating content, Generative AI can whip up something in a fraction of the time. This efficiency boost is a huge advantage, especially for businesses and organisations looking to streamline their operations and get things done faster.

- **Personalisation:** Generative AI takes personalisation to a whole new level. It can tailor content specifically for each person, taking into account their likes, dislikes, and behaviours. This means that instead of getting generic recommendations or articles, users get content that's made just for them. Whether it's suggesting products they might love or delivering news articles on topics they're interested in, Generative AI ensures that each user's experience is unique and relevant to their tastes and preferences. It's like having a personal assistant that knows exactly what you want, making the online experience more enjoyable and engaging.

- **Exploration:** Generative AI helps us explore new things and make existing stuff better. For example, it can help scientists design new drugs or make industrial processes work smoother. It's like having a super-smart assistant that helps us discover new ideas and improve how things work in different fields.

- **Accessibility:** Generative AI makes it easier for everyone to create top-notch content, even if they don't have fancy tools or tonnes of know-how. It's like leveling the playing field, giving everyone a chance to make something awesome without needing special skills or expensive equipment. Whether it's designing graphics, writing stories, or making music, Generative AI opens up a world of creative possibilities for people from all walks of life.

- **Scalability:** Generative AI is a powerhouse when it comes to creating lots of content in a short time. It's like having a super-speedy content creator that can churn out stuff on a large scale without breaking a sweat. This makes it perfect for businesses and organisations that need to produce heaps of content, whether it's articles, images, videos, or anything else. With Generative AI, scaling up content production is a breeze, helping businesses keep up with demand and reach more people without sacrificing quality.

Limitations of Using Generative AI

Some disadvantages of Generative AI are as follows:

- **Data bias:** When Generative AI learns from biased or incomplete data, it tends to reflect those biases in its output. This means the results may be skewed or flawed, especially in critical areas like facial recognition or natural language processing, where accuracy is paramount.
- **Uncertainty:** Generative AI has a knack for surprising us with unexpected results. While this can sometimes lead to exciting discoveries, it can also be a bit of a mixed bag, as the outcomes can be unpredictable.
- **Computational demands:** Generative AI isn't shy about its appetite for computational power. It demands hefty resources for training and generating output, which can be both expensive and time-consuming. So, while it's undeniably powerful, it can also drain the resources.

Ai Task

#Experiential Learning

GAN Paint

CBSE Handbook

Link: https://ganpaint-v2.vizhub.ai/

- GAN Paint directly activates and deactivates neurons in a deep network trained to create pictures.
- Each left button ("door", "brick", etc.) represents 20 neurons.
- The software shows that the network learns about trees, doorways, and roofs by drawing.
- Switching neurons directly shows the network's visual world model.
- To use GAN Paint, you will first need to select a base image from the website's library. You can then use the brush tool to add objects and textures to the image. As you paint, the GAN network will learn to generate more realistic images.
- You are encouraged to experiment with GAN Paint and see what you can create. Have fun!

Generative AI Tools

There are many generative AI tools available today that enable users to create and experiment with generative models. These generative AI tools offer strong abilities for both creative and practical uses in many areas. By using these tools, people can improve their projects, create new content, and discover the potential of AI-driven creativity. Let's study about some of the popular tools.

Artbreeder

Artbreeder is a web-based tool where you can make and change pictures using advanced AI technology called generative adversarial networks (GANs). With Artbreeder, you can mix different images and text together and adjust specific features to create completely new and unique artworks.

You may work on Artbreeder using the given link https://www.artbreeder.com/

You can use it for free with some limitations or choose a paid plan for more features and options. It helps you:

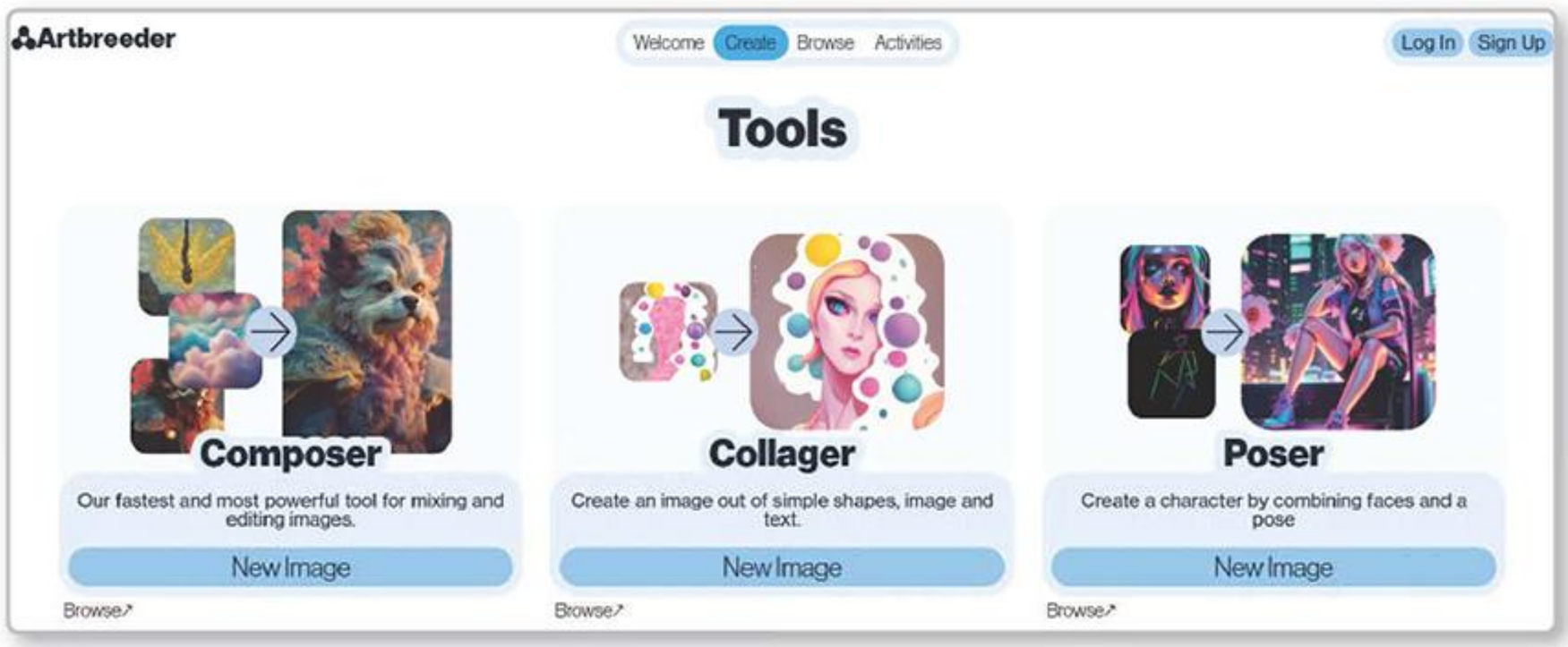
- create new characters by blending and modifying existing images.
- generate imaginative and unique artworks to use in stories, games, or movies.
- experiment with different image combinations and features to discover new artistic possibilities.

AI Task

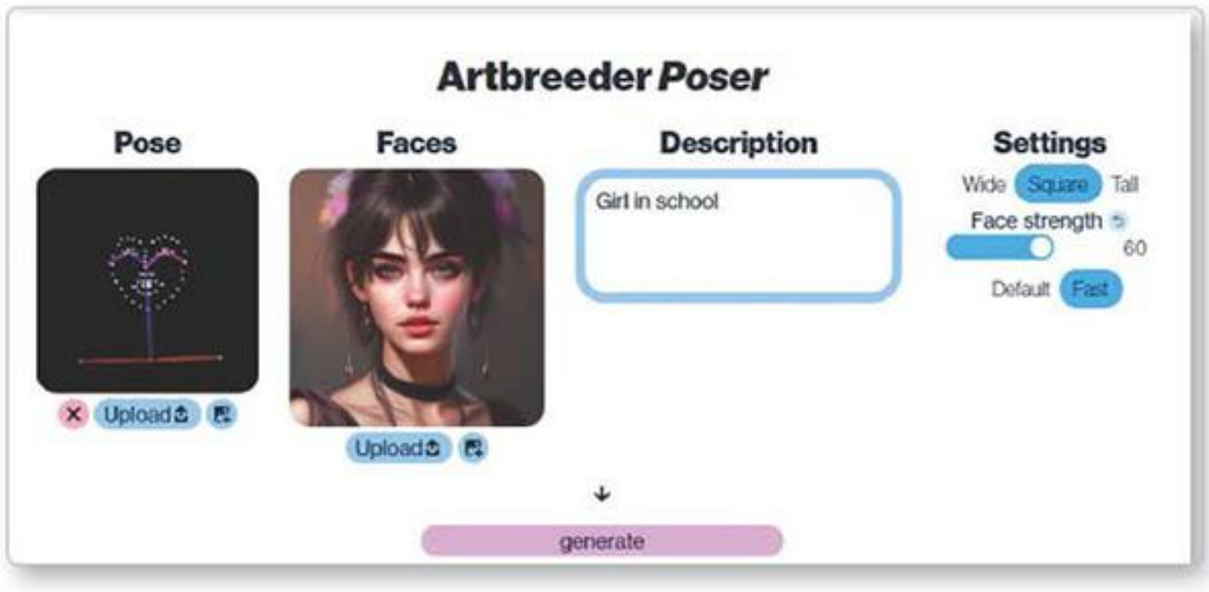
#Experiential Learning

Generate Images with Text Prompt

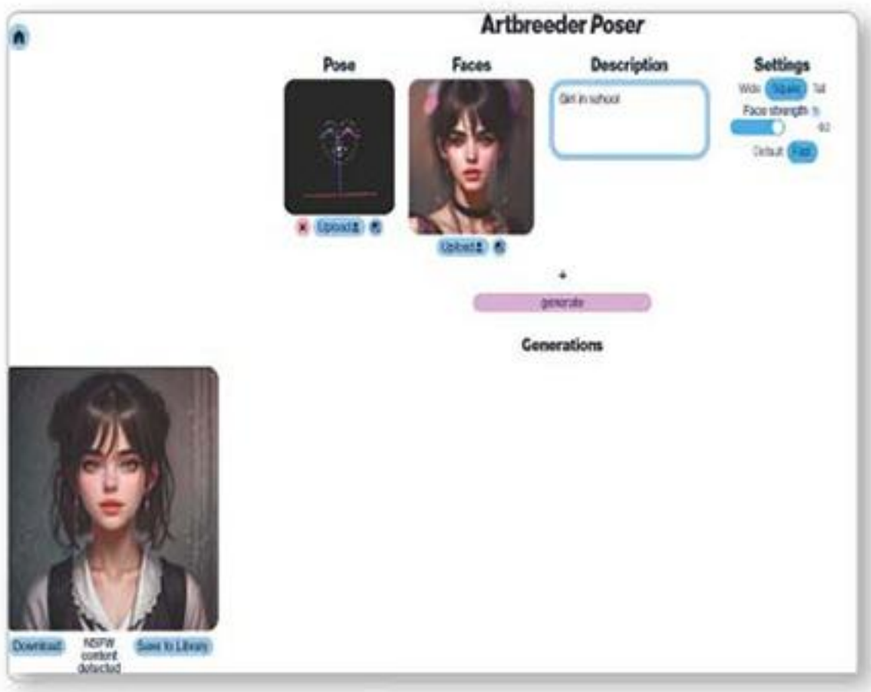
1. Go to https://www.artbreeder.com/
2. Select **Create** from the menu bar and click on **New Image** under the **Poser** category.



3. Enter text in the **Description** box and click on the **generate** button.



See how AI generates a picture based on the description.



Now, create a new image of a boy standing in rain.

You may try creating new images.

ChatGPT

It is an AI tool created by OpenAI. It generates responses like humans in real-time, based on the user's input. It can give natural answers to questions in a conversational tone and can generate stories, essays, and poems.

You may work on ChatGPT using the link https://chat.openai.com.

It can:

- answer any type of questions
- solve maths or scientific problems
- translate between languages
- debug and fix code
- write a story/poem
- differentiate the things given as input
- rephrase text input

Runway ML

Runway ML is a platform for creating, training, and deploying generative models. It provides a user-friendly interface for building and training various types of generative models, including GANs, VAEs, and image classifiers.

#Experiential Learning

Video Session

Scan the QR code or visit the following link to watch the video:

https://www.youtube.com/watch?v=trXPfpV5iRQ

AI Task

#Experiential Learning

Try the following activities:

1. Go to https://runwayml.com/.

2. Select a tool of your choice and generate new content with it

Create a video by giving text commands.

Brainy Fact

ChatGPT, the world's most popular Gen AI platform, had an average of 1.5 billion monthly visits in 2023.

Gemini

Gemini is a generative multimodal AI model created by Google. Just like ChatGPT, Google Gemini is designed to understand text, images, audio, video, computer code, and more.

It can:

- answer any type of questions
- solve maths or scientific problems

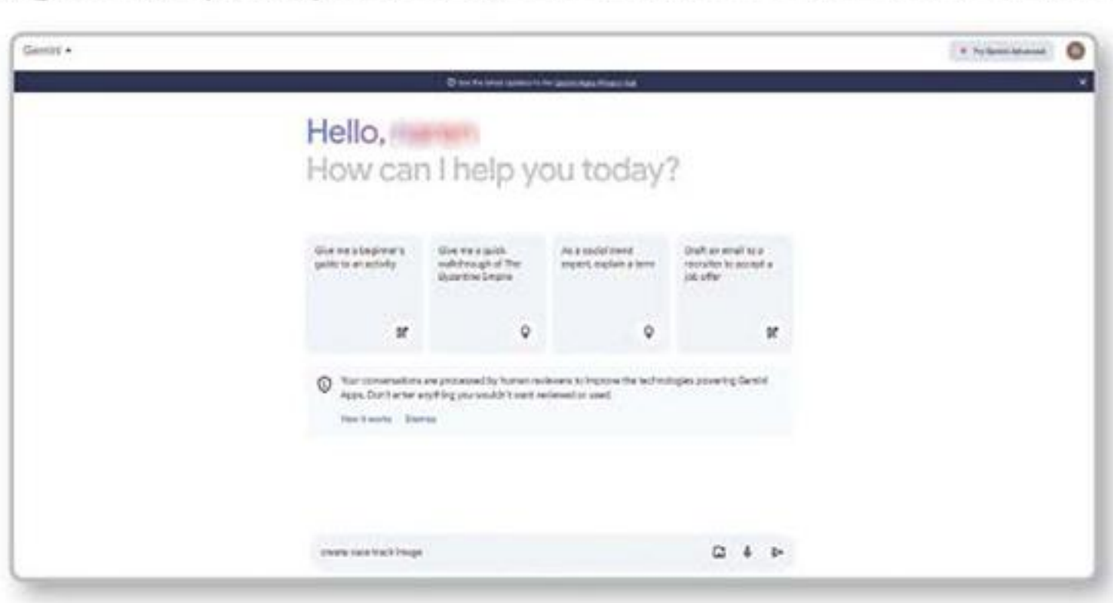
- translate between languages
- debug and fix code
- write a story/poem
- differentiate the things given as input

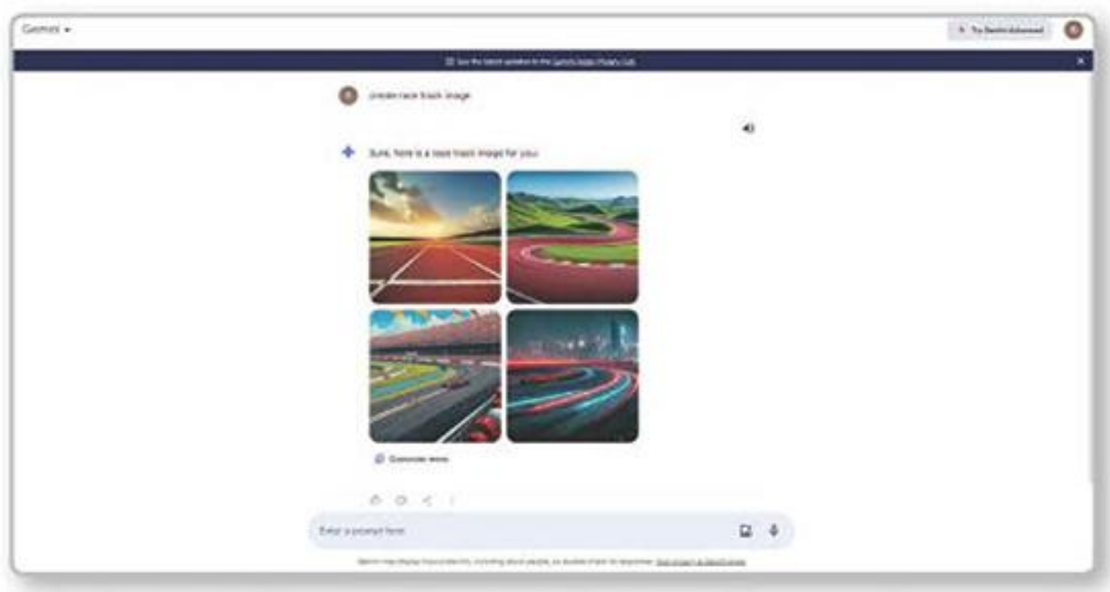
Ai Task

#Experiential Learning

1. Go to https://gemini.google.com/.

2. Click on the **Chat with Gemini** button and follow the instructions given on the screens.
3. On the Welcome page, give the prompts listed below and see the answer that you get.





Copilot

Copilot is an AI tool designed by Microsoft. It can do all the jobs just like ChatGPT and Gemini but it focuses more on software development assistance to streamline the coding process, increase productivity, and assist developers in writing high-quality code faster.

Ai Task

#Creativity & Innovativeness

1. Go to https://copilot.microsoft.com/.

2. Give the prompts listed below and see the answer that you get.

Now, create a new image of a man buying groceries.

Some More Generative AI Tools

Some of the popular generative AI tools that can be used in various fields are shown in the given table.

Video	Muse AI	Vista AI	Topaz AI
Text	Quillbot	Notion AI	Compose
Images	Midjourney	Magic Studio	Pebblely
Design	Viesus	Piggy AI	Galileo

Coding	Bugasura	CodeGPT	Replit Ghostwriter
Audio	FineShare	Boomy AI	Playlist AI
Productivity	Briefly AI	Socra AI	Leexi AI

Ethical Considerations of using Generative AI

While Generative AI offers many benefits, there are also several ethical considerations that should be considered when using this technology.

- **Ownership:** There's a gray area concerning who owns content created by Generative AI. This is especially significant in creative fields like music, literature, and art, where AI can produce original works that blur the lines between human and machine authorship.
- **Human Agency:** Generative AI prompts questions about human control and autonomy. As technology advances, it may become harder to distinguish between content made by humans and that made by machines. This blurring of lines could result in a loss of human agency and control.
- **Bias:** Generative AI learns from the data it's fed, meaning biased data can result in biased AI-generated content. This bias can have harmful effects, particularly in high-stakes areas like hiring, loan approvals, or criminal justice.
- **Misinformation:** Generative AI can be used to create fake news or deep fakes, which can spread misinformation and sway public opinion. This poses a threat to democracy and undermines trust in authorities.
- **Privacy:** There's a risk that Generative AI could be used to generate sensitive personal information, such as credit card numbers or medical records, which could then be exploited for malicious purposes. Protecting privacy is crucial in preventing such misuse.

The Potential Negative Impact on Society

1. **Spread of Misinformation and Fake News**
   a. **Fake News:** AI can generate convincing fake news articles and social media posts, spreading misinformation quickly and widely.
   b. **Deepfakes:** The term "deepfake" combines "deep learning" and "fake," referring to AI techniques that create realistic but fake videos and audios. These AI-generated videos can mislead people by making it seem like someone said or did something which they didn't, undermining trust in public figures and institutions.
2. **Lead to Job Displacement**
   a. **Automation:** Generative AI can perform tasks traditionally done by humans, such as writing, graphic design, and customer service, potentially leading to significant job displacement.

b. **Economic Disruption:** Workers who lose their jobs may struggle financially, face higher unemployment, and find it harder to get new jobs without the required skills.

3. **Privacy and Data Security Risks**

   a. **Sensitive Information:** AI can inadvertently or maliciously generate sensitive personal information, like social security numbers or medical records, which can be exploited for identity theft or fraud.

   b. **Data Breaches:** The misuse of AI to access or generate personal data poses significant risks to an individual's privacy and security.

4. **Ethical and Moral Concerns**

   a. **Bias and Discrimination:** AI models trained on biased data can produce biased outputs, reinforcing stereotypes and discrimination.

   b. **Dehumanisation:** Relying too much on AI for tasks that need human understanding and compassion can make services and interactions feel less personal and caring.

5. **Security Threats**

   a. **Cyber Attacks:** AI can be used to develop sophisticated cyber-attacks, including generating malicious code or automated phishing schemes.

   b. **Weaponisation:** Generative AI could be used to create harmful technologies or weapons, posing significant national security risks.

6. **Environmental Impact**

   a. Training and running large AI models require significant computational resources, contributing to high energy consumption and environmental impact.

   b. Many devices are being exchanged due to outdated hardware leading to increase in e-waste.

Ai Reboot

1. Provide examples illustrating instances where biases in Generative AI are evident.

   _____

   _____

2. What is deepfake?

   _____

   _____

Responsible Use of Generative AI

The responsible use of Generative AI involves:

- Ensuring that the training data used are diverse and representative. Use datasets that reflect a wide range of demographics, cultures, and contexts to avoid biases in AI outputs. Regularly audit and adjust datasets to address and reduce biases.

- The outputs are scrutinised for bias and misinformation. Implement tools and processes to detect biases in AI-generated content.
- Prioritising user privacy and informed consent. Apply strong encryption and data anonymisation techniques to protect user data. Ensure users are aware of and consent to how their data is being used by AI systems.
- Educating stakeholders on ethical use and risks. Provide ongoing education for developers on ethical AI practices and the potential risks of AI misuse. Educate users about the capabilities, limitations, and ethical considerations of AI technology.
- Establishing clear guidelines on ownership and attribution. Define and enforce guidelines regarding the ownership of AI-generated content. Clearly attribute AI-generated content to its sources, distinguishing between human and AI contributions.
- Engaging in public discussions around the social and ethical implications. Foster open discussions with the public about the benefits and risks of Generative AI. Collaborate with policymakers, ethicists, and other stakeholders to develop guidelines and regulations that ensure AI is used in socially beneficial ways.

All these points ensure the responsible use of Generative AI. By emphasising ethics, creating trust, limiting negative repercussions, defining legislation, and encouraging innovation, we maximise generative AI's potential and use it in ways that benefit society.

At a Glance

- AI-generated images are created using AI algorithms.
- Distinguishing between a real image and one generated by AI can be challenging as AI-generated images continue to become more sophisticated.
- Artificial intelligence shows inconsistencies if observed closely, although it tries to piece together its creations from the original work.
- AI-generated images may include elements that seem unrealistic or improbable, such as impossible perspectives, mismatched colors, or objects that defy physics.
- In a supervised learning model, a labelled dataset is given to the machine.
- A labelled dataset is the information which is tagged with identifiers of data.
- Discriminative Modelling is an approach in Machine Learning where the focus is on learning the boundary or decision boundary that separates different classes or categories directly from the data.
- Unsupervised Learning is a type of Machine Learning where the model is trained on input data without any corresponding output labels.
- In Generative Modelling there is no labelled dataset, and the model can generate structured data from the Random Noise dataset.
- A "random noise dataset" typically refers to a collection of data points or samples where each data point is generated randomly.
- Generative Artificial Intelligence also called Gen AI, refers to the algorithms that generate new data that resembles human-generated content, such as audio, code, images, text, simulations, and videos.
- Generative AI is trained with existing data and content, creating the potential for applications such as natural language processing, computer vision, the meta-verse, and speech synthesis.
- GANs are neural networks that work to produce fresh data.
- Variational Autoencoders (VAEs) produces fresh data, learn the distribution of the data and then sample from it.
- RNNs are a special class of neural networks that excel at handling sequential data, like music or text.
- Autoencoders are neural networks that have been trained to learn a compressed representation of data.

Exercise

Solved Questions

SECTION A (Objective Type Questions)

AI Quiz

A. Tick (✓) the correct option.

1. ..... are captured by cameras, they are visual representations depicting scenes, objects, or people in exactly the same way as they exist in the real world.
   a. Real images ◯ b. AI-generated images ◯
   c. Imaginative images ◯ d. Drawings ◯
2. ..... generated images can add modifications, enhancements, and even entirely new imaginative details.
   a. Computer ◯ b. AI ◯
   c. Algorithm ◯ d. Real ◯
3. In Generative Modelling, the model can generate structured data from the ..... dataset.
   a. random noise ◯ b. labelled ◯
   c. unlabelled ◯ d. temporary ◯
4. ..... refers to AI techniques that create realistic but fake videos and audios.
   a. AI ◯ b. Deepfake ◯
   c. Copyright ◯ d. Plagiarism ◯
5. Creating portraits of non-existing people can be done using .....
   a. Paint ◯ b. GANs ◯
   c. VAEs ◯ d. RNNs ◯
6. In a supervised learning model, a ..... dataset is given to the machine.
   a. Unlabelled ◯ b. labelled ◯
   c. New ◯ d. Stored ◯
7. ..... can be used to generate large volumes of content quickly and efficiently.
   a. Supervised learning ◯ b. Unsupervised ◯
   c. Generative AI ◯ d. Deepfake ◯
8. Name the type of Generative AI used for creating new sentences that mimic the style of Shakespeare or generating dialogue for a chatbot.
   a. Real Data ◯ b. GANs ◯
   c. VAEs ◯ d. RNNs ◯
9. In generative AI, a ..... is the initial input or instruction given by the user to the AI model to guide it in generating the desired content.
   a. dataset ◯ b. prompt ◯
   c. data ◯ d. information ◯
10. Name the type of generative AI used for artistic image creation based on learned features from famous paintings.
    a. AEs ◯ b. GANs ◯
    c. VAEs ◯ d. RNNs ◯

B. Fill in the blanks.

1. An AI-generated image is created using AI .....
2. The misuse of AI to access or generate personal data poses significant risks to individual's ..... and ..... .
3. A ..... dataset is the information, which is tagged with identifiers of data.
4. In ..... modelling there is no labelled dataset.
5. Gen AI is gaining popularity due to the fact that people can use ..... to prompt AI.
6. ..... models are typically trained using supervised, unsupervised, or reinforcement learning techniques.
7. If generative AI is trained on biased or incomplete data, the output may be similarly .....
8. ..... is a platform for creating, training, and deploying generative models.
9. ..... is a web-based tool where you can make and change pictures using advanced AI technology called Generative Adversatial Networks (GANs).
10. ..... is a generative multimodal AI model created by Google.

C. State whether these statements are true or false.

1. Generative AI is trained with new data and content. .....
2. In a text generation model, a prompt could be a sentence or a few keywords. .....
3. The output generated by generative AI often achieves a level of quality indistinguishable from human creation. .....
4. Generative AI can produce content even better than humans. .....
5. GNNs work by compressing the data into a lower-dimensional form (encoding) and then decompressing it back to its original form (decoding). .....
6. "The Next Rembrandt Project used in data analysis" is an example of Generative AI in music. .....
7. The discriminator in GANs helps to distinguish between real and generated data. .....
8. Misinformation created by generative AI does not have any serious social impacts. .....
9. Generative AI tools are not capable of personalising content for individual users. .....
10. Privacy concerns in generative AI include the risk of generating sensitive personal information. .....

SECTION B (Subjective Type Questions)

A. Short answer type questions:

1. How can you tell if an image is real or AI?

Ans. Artificial intelligence shows inconsistencies if observed closely, although it tries to piece together its creations from the original work. Odd outlines to sharpen or smoothen the edges, stray pixels to cover inconsistency, and abnormal shapes can be easily seen, if an image is zoomed to the maximum, on each of its parts.

2. What are the environmental impacts of generative AI?

Ans.
- Training and running large AI models require significant computational resources, contributing to high energy consumption and environmental impact.
- Many devices are being exchanged due to outdated hardware leading to increase in e-waste.

3. List the important features of real images captured by camera.

Ans. Real images captured by cameras are visual representations depicting scenes, objects, or people in exactly the same way as they exist in the real world. These images are created by humans or nature and are unaltered.

4. What is a supervised learning model?

Ans. In a supervised learning model, a labelled dataset is given to the machine. A labelled dataset is the information, which is tagged with identifiers of data. For example, clothes in a store are marked under various categories of clothing like Shirts, Trousers, Coats, etc. They are further labelled as per gender and size.

5. Explain the term deepfake.

Ans. The term "deepfake" combines "deep learning" and "fake," referring to AI techniques that create realistic but fake videos and audio. These AI-generated videos can mislead people by making it seem like someone said or did something they didn't, undermining trust in public figures and institutions.

6. What is the use of Generative Modelling?

Ans. Generative modelling is a specific approach within unsupervised learning that focuses on understanding and modelling how the data is generated.

7. What is a random noise dataset?

Ans. A "random noise dataset" typically refers to a collection of data points or samples where each data point is generated randomly. There are unpredictable fluctuations and disorganised data, which makes it impossible to identify target patterns or relationships in it. This may result in decreased accuracy or reliability of the output, which the generative AI model takes care of.

8. What is Generative AI?

Ans. Generative Artificial Intelligence (AI), also called Gen AI, refers to the algorithms that generate new data that resembles human-generated content, such as audio, code, images, text, simulations, and videos.

9. Differentiate between Generative AI and Conventional AI in terms of goals.

Ans. Generative AI creates new content that mimics the original content. This content includes images, text, music, or other forms of media. Whereas conventional AI analyses, processes, and classifies data. It basically works to improve the accuracy, precision, recall, and speed within the scope of the defined task.

10. Explain VAEs with example.

Ans. This is another class of generative models. In order to produce fresh data, VAEs learn the distribution of the data and then sample from it.

Example: Generation of new images similar to the given training set. For instance, a VAE trained on images of faces can generate new, realistic-looking faces.

B. Long answer type questions:

1. How does Discriminative Modelling contrast with Generative Modelling?

Ans. In supervised learning, discriminative modelling contrasts with generative modelling, where the goal is to model the joint probability distribution of both the input features and the output labels. Generative models can be used to generate new data points that resemble the training data, whereas discriminative models are primarily focused on classification or regression tasks.

2. What are the limitations of Gen AI?

Ans. Limitations of Using Generative AI

- **Data bias:** If generative AI is trained on biased or incomplete data, the output may be similarly biased or flawed. This can lead to inaccurate or problematic results in certain applications, such as in facial recognition or natural language processing.

- **Uncertainty:** Generative AI can produce unexpected and often unpredictable results, which can be both a benefit and a drawback.
- **Computational demands:** Generative AI requires significant computational resources to train and generate its output, which can be expensive and time-consuming.

3. Explain the concept of Recurrent Neural Networks with example.

Ans. RNNs are a special class of neural networks that excel at handling sequential data, like music or text. They excel at tasks where the order of the data points is important, as they can remember previous inputs and use this information to influence current outputs.

For example, it can generate novel text in the style of a specific author or genre, like creating new sentences that mimic the style of Shakespeare or generating dialogue for a chatbot.

4. Explain how generative AI is being used in Art with example.

Ans. Generative AI can create new artworks by learning styles from famous painters and generating novel pieces in similar styles.

For example:

- AI artists like "AI Portraits" and "DeepArt" have gained popularity for their ability to create visually stunning images.
- The Next Rembrandt project used data analysis and 3D printing to create a new painting in the style of Rembrandt.

5. Give three benefits of using generative AI.

Ans.
- **Creativity:** Generative AI can assist creatives in pushing the boundaries in making creative processes more efficient and personalised. This can be particularly valuable in fields such as art, design, and music.
- **Efficiency:** Generative AI can automate content creation processes, which can save time and reduce costs compared to traditional manual processes.
- **Personalisation:** Generative AI can be used to create personalised content for individual users based on their preferences and behaviours, such as customised product recommendations or personalised news articles.

C. Competency-based/Application-based questions:

#Environmental Awareness

1. Hema is a content creator using a generative AI tool to produce images for a marketing campaign. How would she ensure the images generated by the AI look original and are not infringe on any existing copyrights? What steps would she take to verify the originality of the AI-generated content?

Ans. Hema can ensure the images generated by AI look original by utilising AI tools designed to create unique content and by cross-referencing the outputs with existing image databases to check for similarities. She should employ copyright verification services to detect any potential infringements. Additionally, using licensed AI tools that guarantee original outputs can help. Finally, Hema should keep detailed records of the AI's generation process for accountability.

2. "OrStim" organisation is using generative AI to create synthetic voices for virtual assistants. How would the company ensure the synthetic voices are natural and engaging while avoiding any potential misuse, such as generating misleading or harmful audio content? What guidelines should the company establish for ethical use?

Ans. "OrStim" can ensure the synthetic voices are natural and engaging by training the AI on diverse and high-quality voice datasets, focusing on clarity and emotional expression. To avoid misuse, they should implement filters to detect and block harmful or misleading content generation.

Assertion and Reasoning Question:

3. The given question, consists of two statements – Assertion (A) and Reasoning (R). Answer these questions by selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

Assertion (A): Supervised learning requires labelled data for training.

Reasoning (R): In supervised learning, the algorithm learns from input-output pairs provided in the training data, allowing it to generalise and make predictions on new data based on the learned patterns.

Ans. a

Unsolved Questions

SECTION A (Objective Type Questions)

AI Quiz

A. Tick (✓) the correct option.

1. Based on the ..... data in discriminative modelling, the model is able to identify individual datasets.
   a. Unlabelled ◯ b. New ◯
   c. labelled ◯ d. Named ◯

2. ..... are unpredictable fluctuations and disarranged data which makes it impossible to identify target patterns or relationships in it.
   a. Deepfake ◯ b. Random Noise Dataset ◯
   c. Gen AI ◯ d. Discriminative Modelling ◯

3. Which of the following is not a generative AI tool?
   a. Galileo ◯ b. CodeGPT ◯
   c. Magic AI ◯ d. Vista AI ◯

4. ..... are neural networks that work to produce fresh data.
   a. Deepfake ◯ b. Gen AI ◯
   c. GANs ◯ d. VAE ◯

5. What is a primary advantage of using Autoencoders?
   a. Generating realistic videos ◯ b. Creating noise-free images ◯
   c. Handling sequential data ◯ d. Generating new text ◯

6. Which generative AI tool is designed to understand text, images, audio, video, and code?
   a. ChatGPT ◯ b. Runway ML ◯
   c. Gemini ◯ d. Copilot ◯

7. What potential negative impact on society is associated with generative AI?
   a. Enhanced creativity ◯ b. Job displacement ◯
   c. Increased efficiency ◯ d. Personalisation of content ◯

8. What does a "prompt" in generative AI refer to?
   a. The initial input or instruction given by the user to the AI model ◯
   b. The output generated by the AI model ◯
   c. The training dataset used by the AI model ◯
   d. The algorithm used to train the AI model ◯

9. Which technology introduced the concept of the world's first neural network?
   a. Transformers ◯ b. Perceptron ◯
   c. RNNs ◯ d. GAN ◯

B. Fill in the blanks.

1. An ..... learning approach works on an unlabelled dataset.
2. Generative AI could be used to create harmful technologies or weapons, posing significant ..... risks.
3. The goal of ..... is to find patterns, structures, or representations in data without human interventions.
4. The ethical consideration of ..... in generative AI involves the risk of generating biased or discriminatory content.
5. ..... can help in drug discovery by learning and generating molecular structures that have desirable properties.
6. A major risk associated with generative AI is the potential to create misinformation, such as ..... and deepfakes.
7. Recurrent Neural Networks (RNNs) are especially good at handling ..... data like text and music.
8. Generative AI refers to algorithms that create new data resembling ..... generated content.
9. The AI tool Artbreeder is used for blending and modifying ..... using GANs.
10. ..... provides a user-friendly interface for building and training various types of generative models, including GANs, VAEs, and image classifiers.

C. State whether these statements are true or false.

1. Generative AI can explore new design spaces and optimise systems. .....
2. Generative AI is a powerhouse when it comes to creating lots of content in a short time. .....
3. The generator in GANs evaluates the generated data to ensure it is realistic. .....
4. An important application of RNNs is predictive text input. .....
5. Both AE and VAE consist of an encoder and a decoder network. .....
6. Runway ML is a platform for creating and deploying Art work and is part of chatGPT. .....
7. Generative AI is not capable of composing new music or remixing existing pieces. .....
8. Variational Autoencoders (VAEs) are used to sample new data from learned data distributions. .....
9. Generative AI algorithms are primarily used to analyse data rather than create new data. .....
10. We have no setbacks using Generative AI. .....

D. Match the following:

1. Supervised Learning model	a. Arts
2. GAN	b. Initial input given to the AI model
3. Generative AI	c. Generator Network & Discriminator Network
4. Prompt	d. Creates noise-free images
5. VAEs	e. Labelled

SECTION B (Subjective Type Questions)

A. Short answer type questions:

1. Write one difference between Autoencoders (AEs) and Variational Autoencoders (VAEs).
2. Give two examples of VAEs.

3. When was Google DeepMind's AlphaGo introduced?
4. Write the names of any four generative AI tools.
5. Differentiate between generative AI and conventional AI in terms of applications.
6. Generative AI models need large training data. Elaborate.
7. Explain the limitations of using generative AI in terms of data bias.
8. Give two important feature of the popular tool - Artbreeder.
9. Give two ethical considerations of using generative AI.
10. "Generative AI is a threat to privacy and has data security risks." Explain in short.

B. Long answer type questions:

1. Explain in detail the use of generative AI in the field of music.
2. What are Autoencoders? List its important features with examples.
3. Draw a diagram to represent Recurrent Neural Networks.
4. Give one point to support how generative AI can be helpful in following fields:
   a. Architecture
   b. Coding
   c. Music
   d. Content Creation

C. Competency-based/Application-based questions:

#Environmental Awareness

1. Sakshi has been assigned a homework essay on the topic, "The Impact of Climate Change on Coral Reefs." The essay requires Sakshi to research and explain various aspects of climate change, such as ocean acidification and rising sea temperatures, and their effects on coral reef ecosystems. His friend suggested using some text generation tools. List some guidelines for Sakshi to prevent misuse of generative AI and use it constructively.
2. How do you think generative AI can revolutionise the creative industry, such as art and fashion, by enabling the generation of unique and innovative designs?
3. Considering the ethical challenges associated with generative AI, what are your thoughts on establishing guidelines or regulations to ensure responsible use of these technologies? How can we balance the potential benefits and risks?
4. Find out ChatGPT vs. Gemini vs. Copilot on the basis of:
   - Parameter 1: Human-Like Response.
   - Parameter 2: Training Dataset and Underlying Technology.
   - Parameter 3: Authenticity of Response.
   - Parameter 4: Access to the Internet.
   - Parameter 5: User Friendliness and Interface.
   - Parameter 6: Text Processing: Summarisation, Paragraph Writing, Etc.
   - Parameter 7: Charges and Price
5. Shinjini is a university student majoring in Architecture. She is working on a project for her digital art class where she needs to create a series of concept sketches for designing a fictional bridge. However, she is struggling to come up with creative ideas and wants to explore different concepts quickly where generative AI can be used.

   List how she can responsibly use generative AI to design her project.

Assertion and Reasoning Question:

6. The given question, consists of two statements – Assertion (A) and Reasoning (R). Answer these questions by selecting the appropriate option given below:

   (a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

Assertion (A): Unsupervised learning is used when the data lacks labelled outcomes.

Reasoning (R): Unlike supervised learning, unsupervised learning deals with unlabeled data where the algorithm seeks to find patterns or structures in the data without explicit guidance on the output, often used for clustering or dimensionality reduction tasks.

Ai In Life

#Interdisciplinary

Generative AI enables media and entertainment companies to streamline content creation processes. These AI models can generate original scripts, articles, and even music compositions, freeing up human creators to focus on more complex and creative tasks. Using one of these tools, prepare a skit for your morning class assembly related to the topic chosen.

AI Deep Thinking

#Problem Solving & Logical Reasoning

How might the widespread adoption of generative AI impact job markets, particularly in creative industries such as art, writing, and music?

Ai Lab

#Experiential Learning

1. Visit the shared link and determine which one is a real image or an AI-generated image.

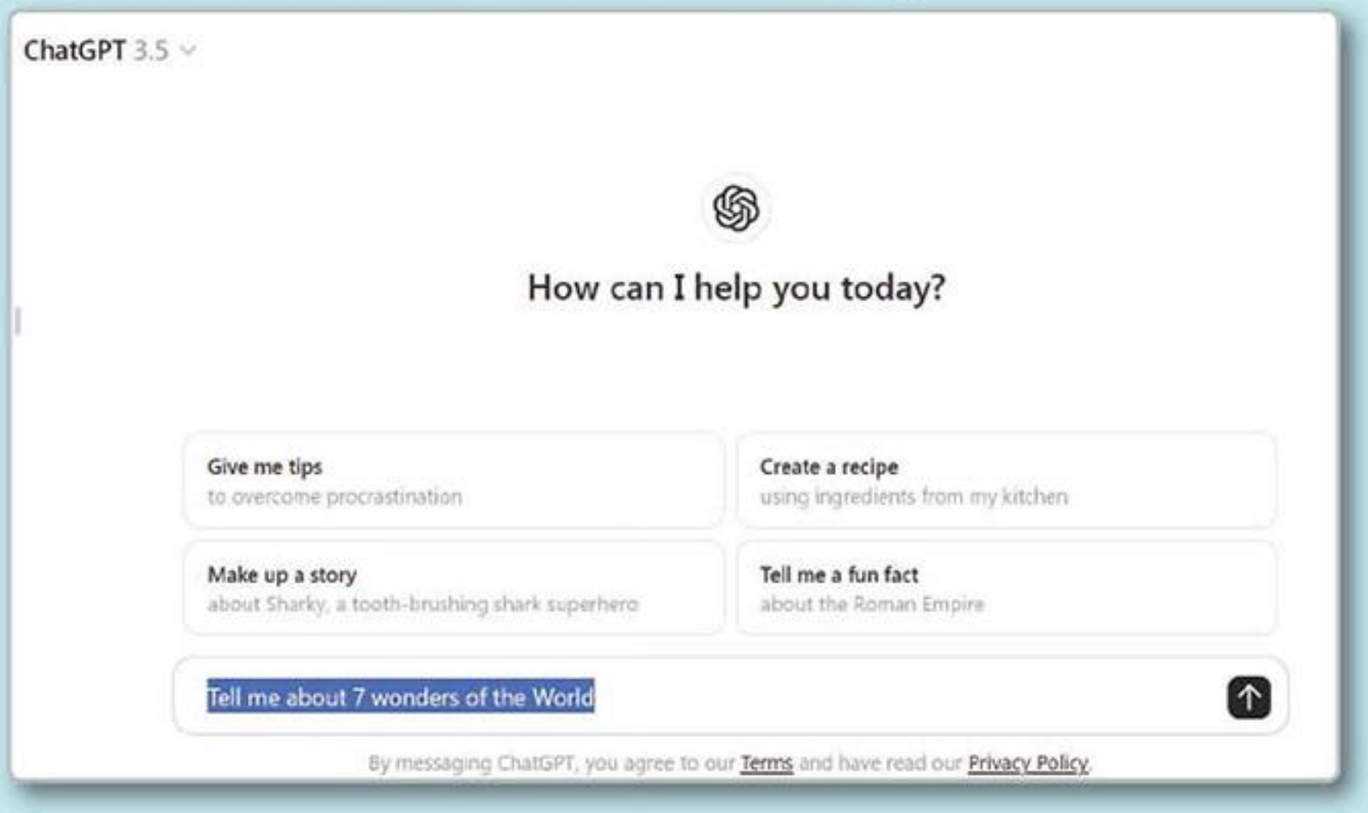
   https://britannicaeducation.com/blog/quiz-real-or-ai/

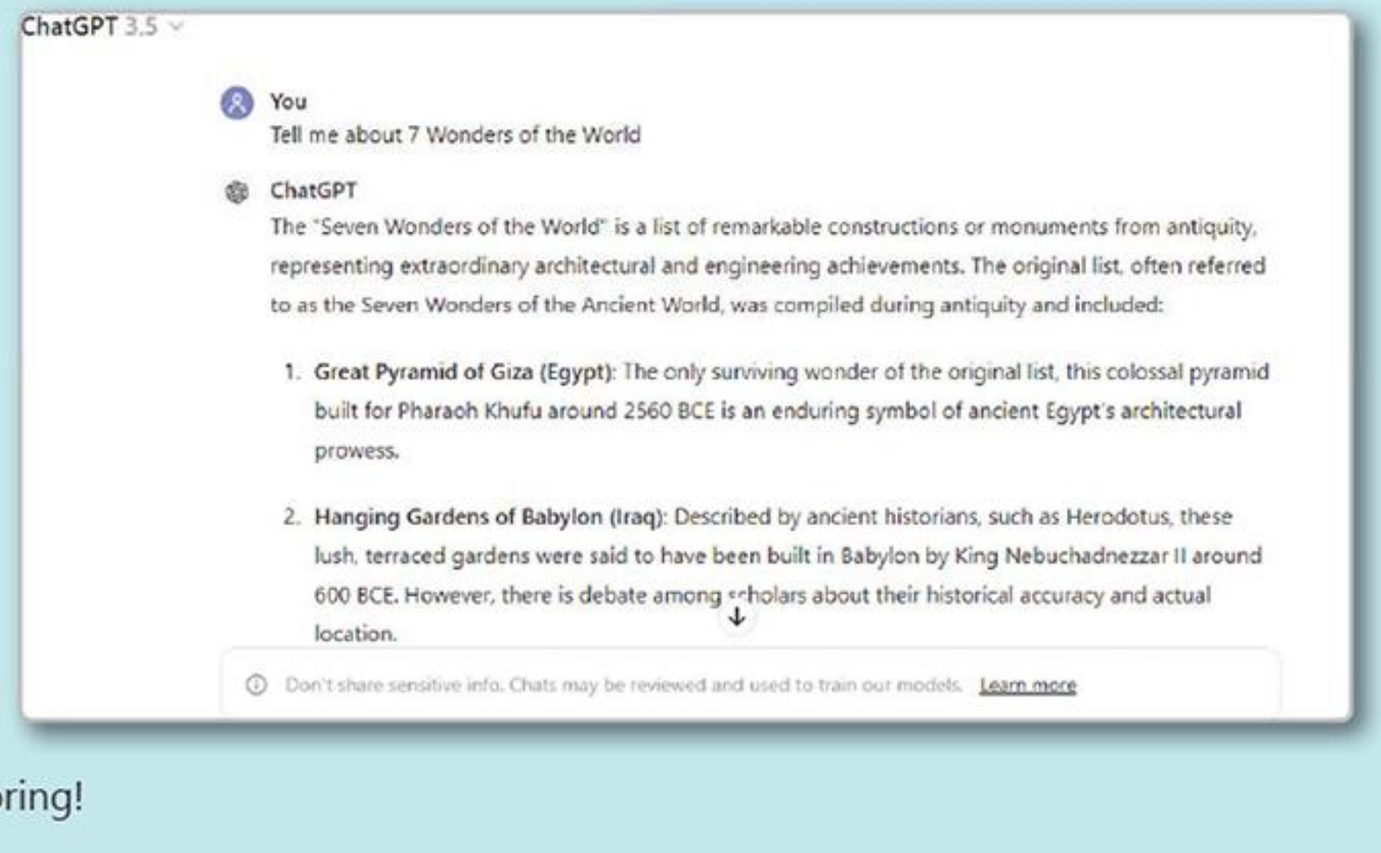
   State 5 points you have noted for easy identification of AI-generated image.

2. Explore the ChatGPT tool:

   a. Go to https://chat.openai.com/

   b. Give the prompts listed below and see the answer that you get.





3. Enjoy Exploring!

Answers

Exercise (Section A)

A. 1. a 2. b 3. a 4. b 5. b 6. b 7. c 8. d 9. b 10. a

B. 1. algorithms 2. privacy, security 3. labelled 4. Generative 5. Natural Language
6. Conventional AI 7. biased 8. Runway ML 9. Artbreeder 10. Gemini

C. 1. False 2. True 3. True 4. True 5. False
6. False 7. True 8. False 9. False 10. True

1. Can we consider the data acquired from ChatGPT to be authentic? Justify your answer.

2. What sets Gemini apart from ChatGPT?

3. List any two jobs in the field of Art that will be soon replaced by AI.

4. Expand the term RNN. Give two applications of RNN.

UNIT-5

INTRODUCTION TO PYTHON

Learning Outcomes

- Steps Involved in Computer Problem Solving
- Algorithm
- Difference between Algorithm and Flowchart
- Programming Language
- Important Features of Python
- Applications of Python
- Working in Python
- Statements in Python
- Operator Precedence
- Data Types
- The print() Function
- Errors in Python
- Sequential Statements
- Iterative Statements
- Control Structures
- Flowchart
- What is CodeCombat?
- What is Python?
- Role of Python in Artificial Intelligence
- Installing Python
- Python Character Set
- Tokens
- Variables
- Comments in Python
- The input() Function
- Control Statements
- Selection Statements
- Lists in Python

A computer is just a machine that gives the result based on the instructions or inputs given to it. In order to get a problem solved by a computer, we need to give step-by-step instructions to the computer. *These step-by-step instructions written in any programming language to do a specific task is known as a program.* A program is written in any programming language which the computer can understand and execute. Algorithms and flowchart are powerful tools for learning programming.

In this chapter, we are going to learn about basic concepts of programming including problem-solving, control structure, algorithm, and flowchart.

Steps Involved in Computer Problem Solving

Before we write a program, we need to learn the basic objective of it. Why do we need a program and what purpose does it solve? To solve this problem of writing a program, we follow some steps as given below:

1. **Understanding the problem:** This is a crucial step where we need to understand the main objective of the problem. In this step, we should clearly define the problem, gather all necessary requirements, understand constraints, and clarify goals. These actions are essential to moving in the right direction and finding an effective solution.
2. **Analysing the problem:** Break down the problem into smaller parts, identify inputs and outputs, and explore existing solutions. Consider edge cases and unusual scenarios. This comprehensive analysis sets a detailed plan for tackling the problem.

3. **Developing the solution:** Design a detailed algorithm and choose appropriate tools and technologies. It is always recommended to first write an algorithm and draw a flowchart for solving a problem and then only write the program. This translates analysis into a practical, actionable plan.
4. **Coding and implementation:** This is the last step where every instruction of an algorithm is converted into a computer understandable instruction by using the syntax and semantic of a specific computer language.

Control Structures

Control structures are a set of instructions that control the flow of instructions in a program. It is a programming tool that determines the order of execution of the statements in any programming language. There are three different types of control structures: sequential flow, selection flow, and repetition flow.

Let us learn about these in detail.

Sequential Flow

In sequential flow, the statements are placed one after the other and the flow of execution occurs starting from line 1, line 2 and so on with a top-down approach. It is the default flow followed in any programming language. For example, the steps for calculating the percentage of any student by taking as an input marks of English, Science, Maths are as follows:

Step 1 Start

Step 2 Input Eng, Science, Math

Step 3 Total = Eng+Science+Math

Step 4 Percentage = (Total / Maximum_Marks) * 100

Step 5 Display Percentage

Step 6 Stop

Selection Flow

Selection flow is also known as branching control as the flow of control branches based on a condition. A condition evaluates to either TRUE or FALSE. In the case of TRUE, the flow of control follows the set of instructions written for True. In case it is FALSE, then it follows the other route. For example, consider the scenario where an award is given only if the percentage is more than 90:

Step 1 Start

Step 2 Input Eng,Science, Math

Step 3 Total= Eng+Science+Math

Step 4 Percentage = (Total / Maximum_Marks) * 100

Step 5 Display Percentage

Step 6 If Percentage> 90 then

    Display "Award given"

Step 7 else

    Display "No award"

Step 8 Stop

Repetition Flow

Repetition flow, also known as a loop, repeats a set of instructions a number of times based on a condition. For example, if we wish to repeat the above steps of calculating percentage for 10 students then we use the concept of repetition.

Step 1 Start

Step 2 count=1

Step 3 if count <=10 goto Step 4 else goto step 10

Step 4 Input Eng,Science, Math

Step 5 Total= Eng+Science+Math

Step 6 Percentage = (Total / Maximum_Marks) * 100

Step 7 Display Percentage

Step 8 count=count+1

Step 9 Goto Step 3

Step 10 Stop

Algorithm

An algorithm is a step-by-step approach to identify and solve a problem in a finite amount of time. It is used in the problem-solving phase of any programming task and helps in defining clear instructions in sequence. An algorithm uses simple English-like statements to represent the steps of a program. There may be more than one way to solve any problem, so there may be more than one algorithm for a given problem. It must terminate after a finite number of steps. Once we have an algorithm, we can translate it into a computer program in any programming language.

Brainy Fact

The word 'algorithm' come from the name of a Persian mathematician called Al-Khwārizmī.

Writing an Algorithm

Let us do an activity of writing an algorithm for making cucumber and tomato sandwich:

Step 1 Take a few slices of tomato and a cucumber.

Step 2 Take two slices of multigrain bread.

Step 3 Put tomato sauce on one slice of bread.

Step 4 Put cheese spread on the other slice of bread.

Step 5 Place a few slices of tomato and cucumber between the two slices of bread.

Step 6 Cut the sandwich into two halves and serve it.

Advantages of an Algorithm

The advantages of an algorithm are as follows:

- It is a step-by-step representation of a solution to a given problem.
- It uses simple English-like statements, so it is easy to understand and write.
- The problem is broken down into smaller pieces, hence, it is easy to convert it into a program using any programming language.

Disadvantages of an Algorithm

The disadvantages of an algorithm are as follows:

- There is no standard rule for writing an algorithm, it varies drastically.
- The process of creating an algorithm can be time-consuming.
- It is difficult to represent branching and looping in an algorithm.

Ai Task

#Experiential Learning

Do you think of any other way of making a different kind of sandwich? If yes, write the steps in the form of an algorithm.

Let us look at some other examples of algorithms.

1. Input the temperature in Fahrenheit and convert it into Celsius and display it.

   Step 1 Start
   Step 2 Input Temp(in Fahrenheit)
   Step 3 C=(5/9)*(Temp-32)
   Step 4 Display C
   Step 5 Stop

2. Input the radius of a circle and calculate its area.

   Step 1 Start
   Step 2 Input radius
   Step 3 Area=3.14*radius*radius
   Step 4 Display Area
   Step 5 Stop

3. Input an age and check whether eligible for a driving licence or not.

   Step 1 Start
   Step 2 Input Age
   Step 3 If Age>=18 then
   Display "Eligible"
   Step 4 else
   Display "Not Eligible"
   Step 5 Stop

4. Display even numbers from 2 to 20.

   Step 1 Start

Step 2 N=2

Step 3 If N <= 20 goto Step 4 else goto Step 7

Step 4 Display N

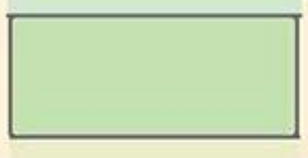
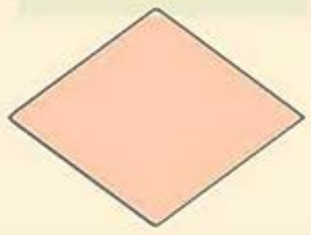
Step 5 N=N+2

Step 6 Goto Step 3

Step 7 Stop

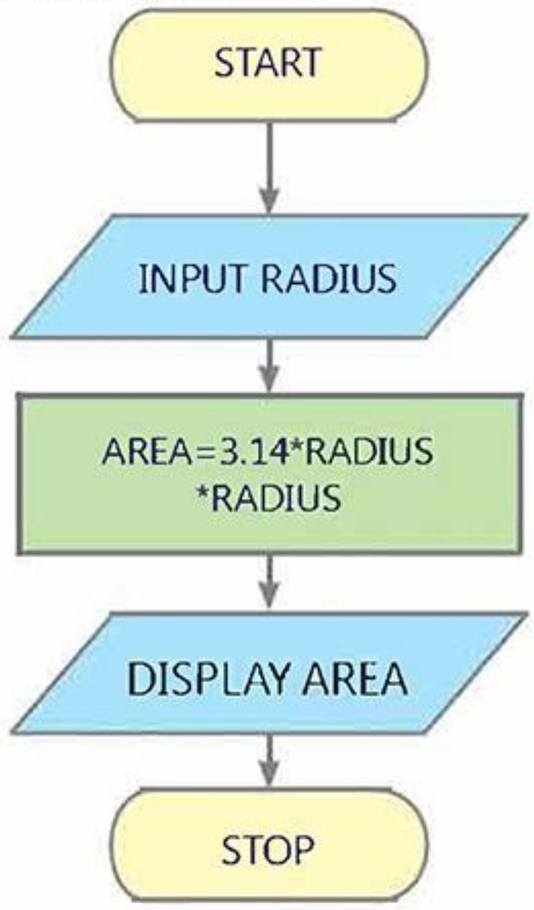
Flowchart

A flowchart is a graphical representation of an algorithm. It makes use of symbols which are connected through arrows to show the direction of flow of information. It has been proved scientifically that visuals have more impact on the human brain as compared with text. So, flowcharts are preferred over algorithms for solving a problem. The symbols are:

SYMBOL NAMES	SYMBOLS	PURPOSE
Oval		Used to start and stop a flowchart.
Parallelogram		Used to take input and display output.
Rectangle		Used to perform assignment, mathematical and processing operations.
Diamond		Used for decision-making in case of branching or looping.
Arrow in any direction		Used to show the direction of flow of information in a flowchart.

Drawing a Flowchart

Let us make a flowchart for calculating the area of a circle.



Advantages of Flowchart

The advantages of a flowchart are as follows:

- It is a better way of communication due to its graphical representation.
- It is an effective way to solve and analyse a problem.
- It is an easier method of converting a program logic into a code using any programming language.
- It makes program or system maintenance easier.
- It is used in preparing documentation of an application or a process.

Disadvantages of Flowchart

The disadvantages of a flowchart are as follows:

- It is a time-consuming process.
- It is difficult to make flowcharts for complex and long programs.
- Modification of the program through flowchart is sometimes tedious.

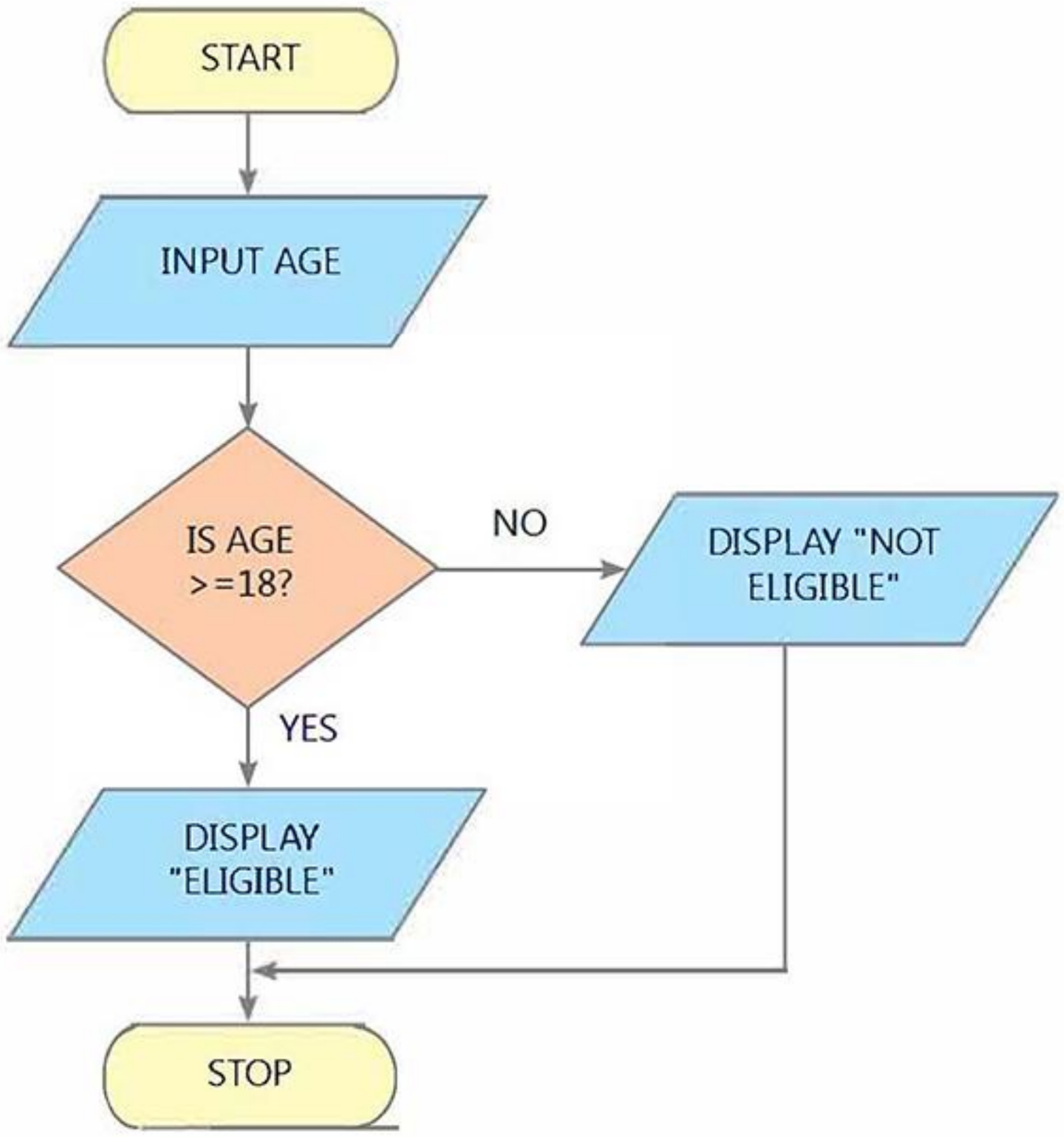
Ai Task

#Coding & Computational Thinking

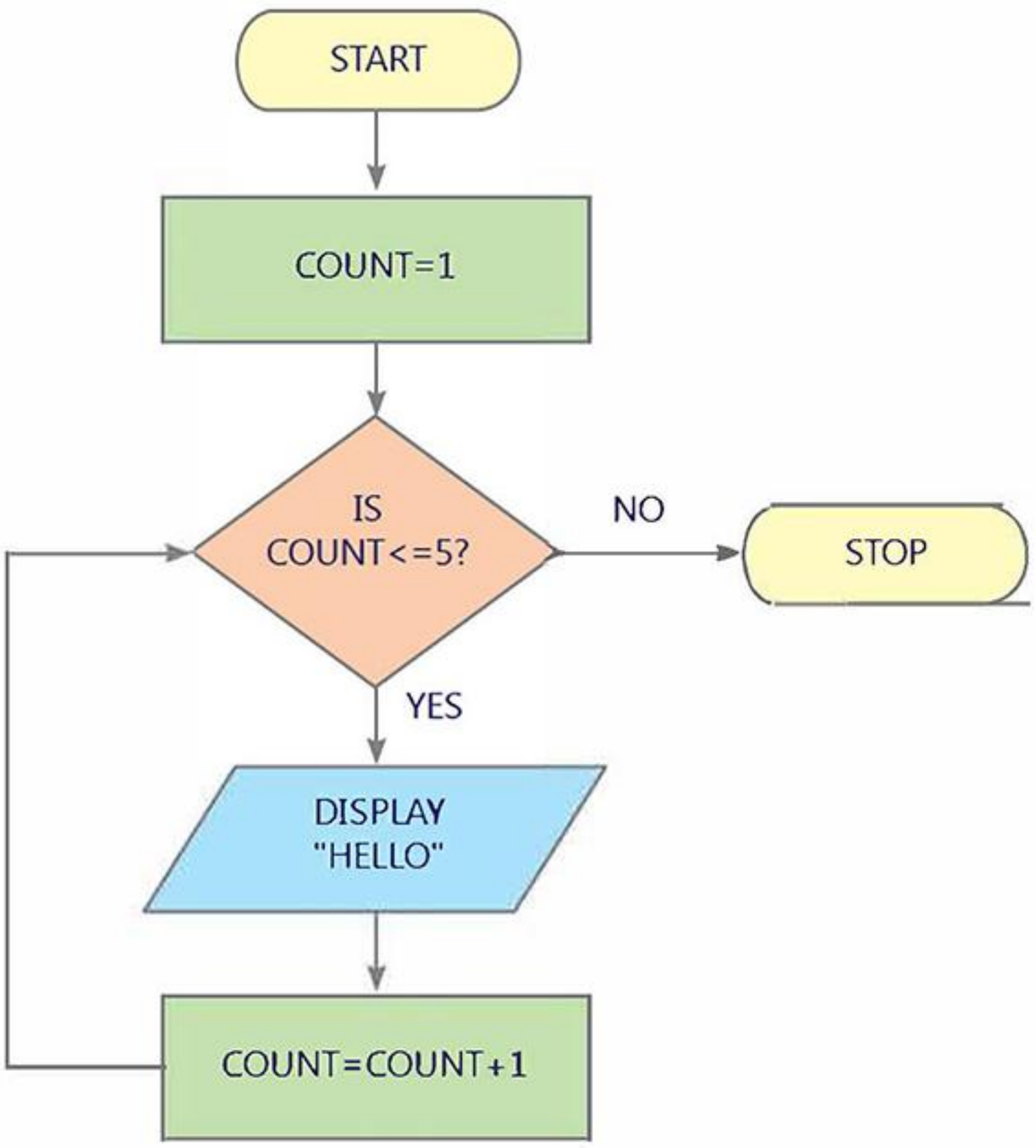
Make a flowchart for calculating the Simple Interest.

If we have to represent branching or looping in flowchart then we use a diamond symbol with directions as YES or NO.

Let us try to find out the age for driving licence using a flowchart.



If we have to repeat the printing of hello five times then the flowchart for this kind of looping will be:



Ai Task

#Coding & Computational Thinking

Make a flowchart for displaying even numbers from 2 to 20.

Difference between Algorithm and Flowchart

Let us look at the differences between an algorithm and a flowchart.

Algorithm	Flowchart
It is a step-by-step textual approach to solve a problem.	It is a graphical representation of a algorithm.
It can be written in natural language, pseudocode, or code.	It uses standardised symbols and shapes.
Difficult to represent branching and looping.	Easily represents branching and looping through symbols.

Algorithm	Flowchart
Errors can be identified through testing and debugging.	Errors can be identified through review and walkthroughs.
Can be used for simple, complex or long processes.	Advisable to use only for simple processes.

What is CodeCombat?

CodeCombat is a free coding educational game that teaches you to learn JavaScript or Python coding in a fun way. It is available for all age groups to suit the needs of all levels of coding and computer science learners. There are self-paced games with practice levels and hints in case you get stuck. If you master the skill of coding then there are few challenge levels also. It is equivalent to doing beginners level courses in any programming language. There are two coding programs:

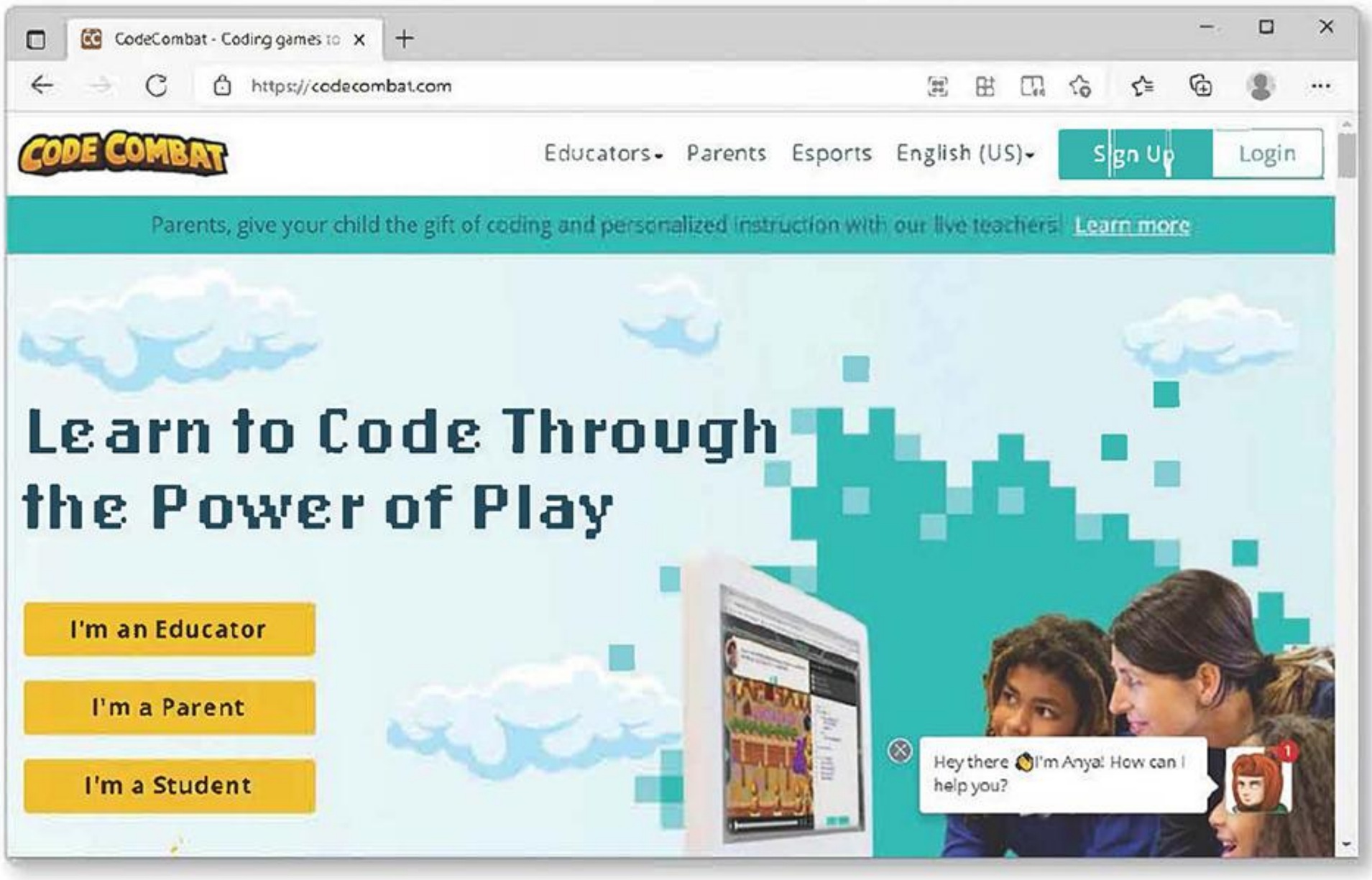
- **CodeCombat:** It is the company's original coding game recommended for parents, individuals, educators and students.
- **Ozaria:** It is an adventure game, fantasy story, and Computer Science program recommended for educators and students.

Using CodeCombat

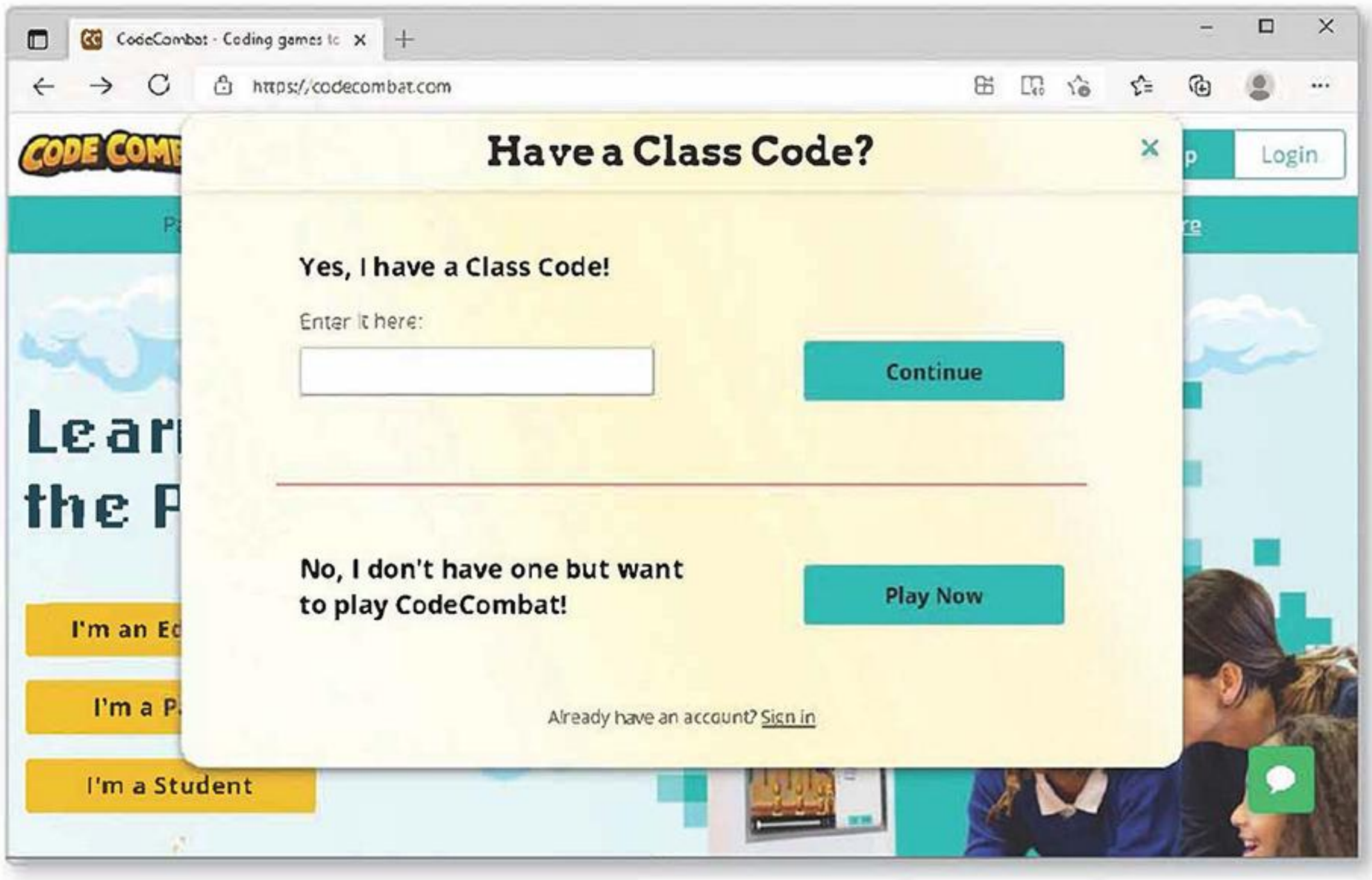
Perform the following steps to use CodeCombat:

Step 1 Open the following link:
https://codecombat.com/

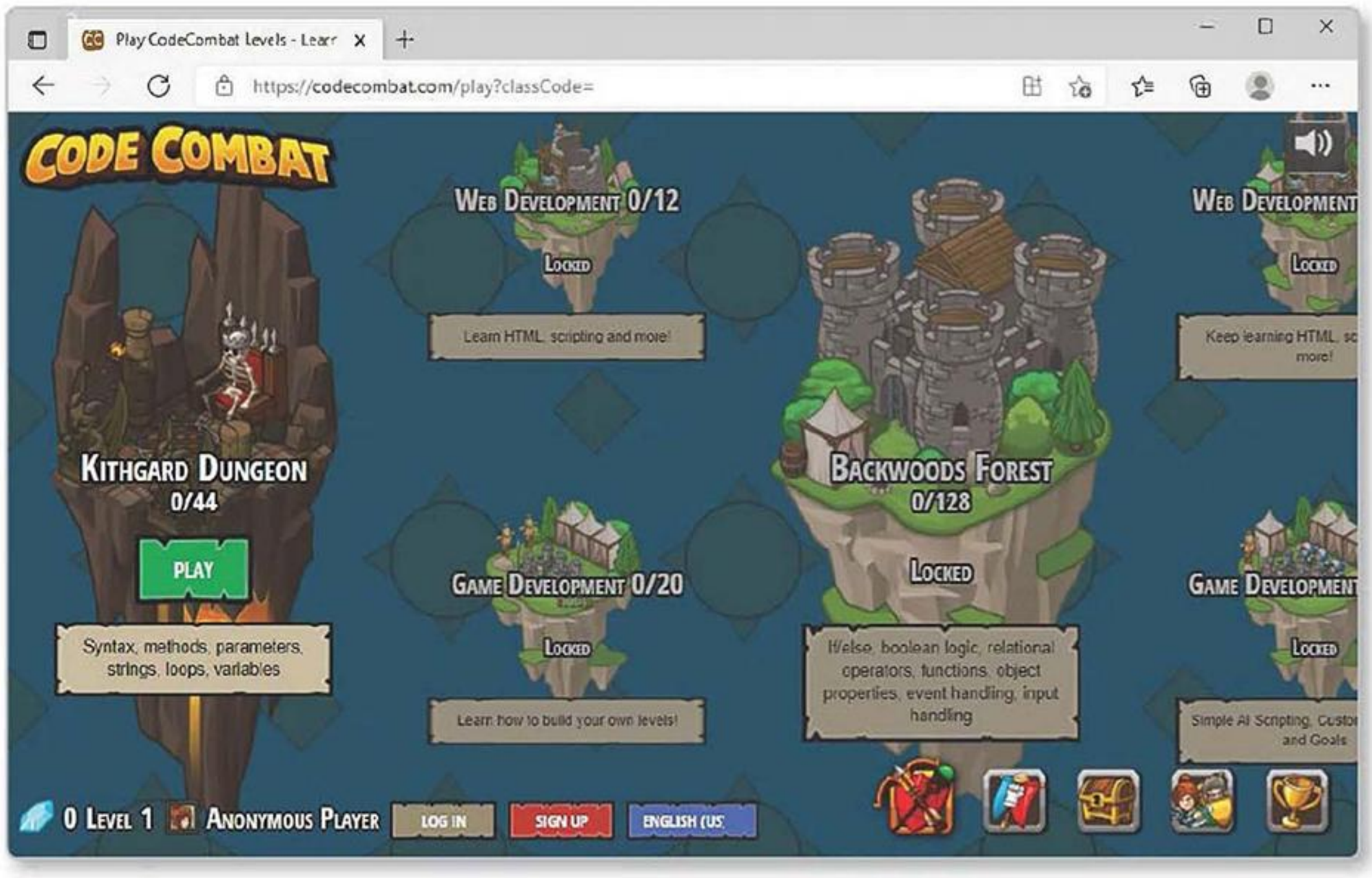
Step 2 Click on the **I'm a Student** button. A pop-up appears asking for class code.



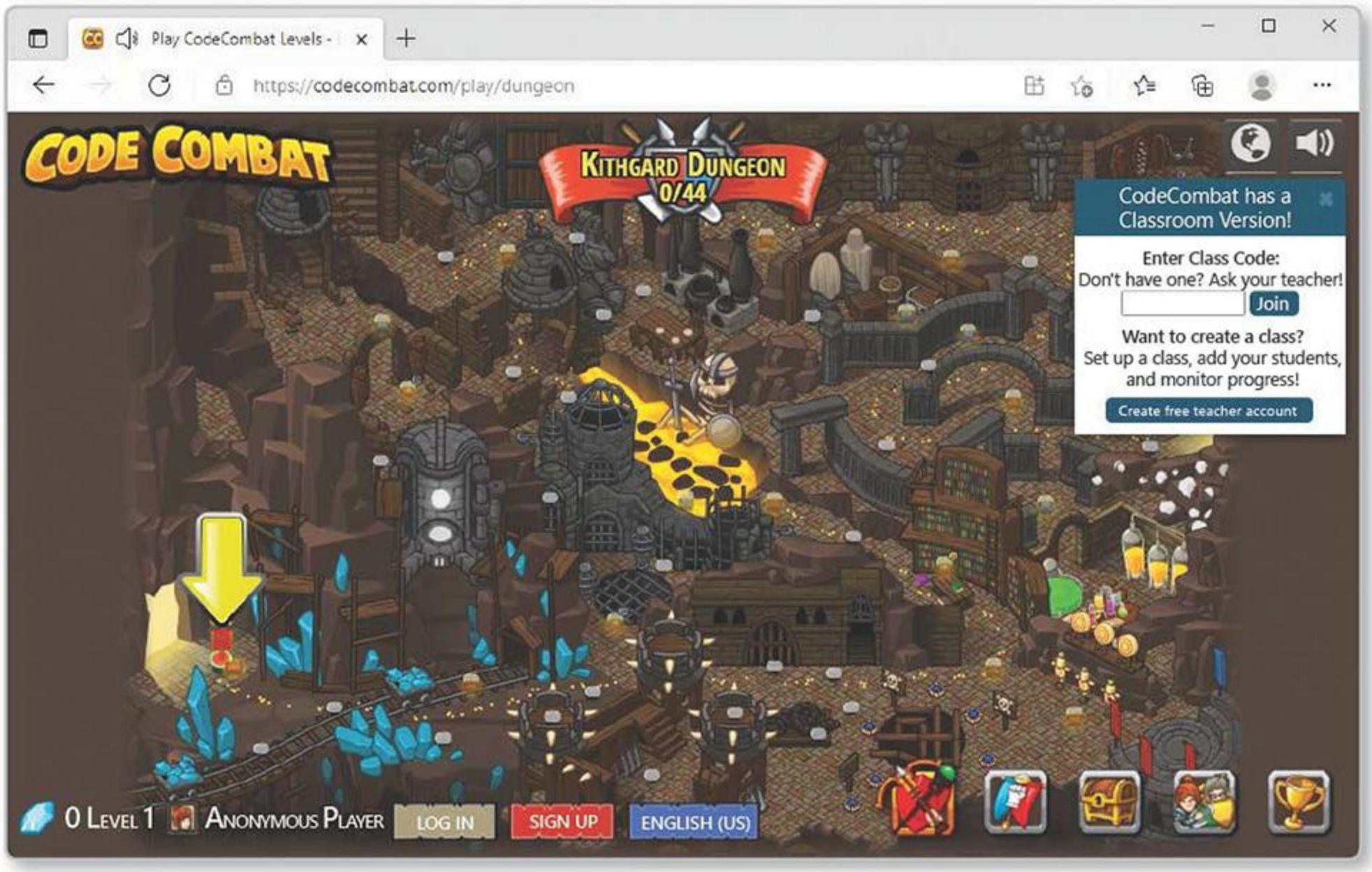
Step 3 Enter the class code if you have, otherwise click on the **Play Now** button. This class code is required when you want to play the game with your class. Your teacher can provide you a class code. When you click on the Play Now button the main screen of the CodeCombat game opens.



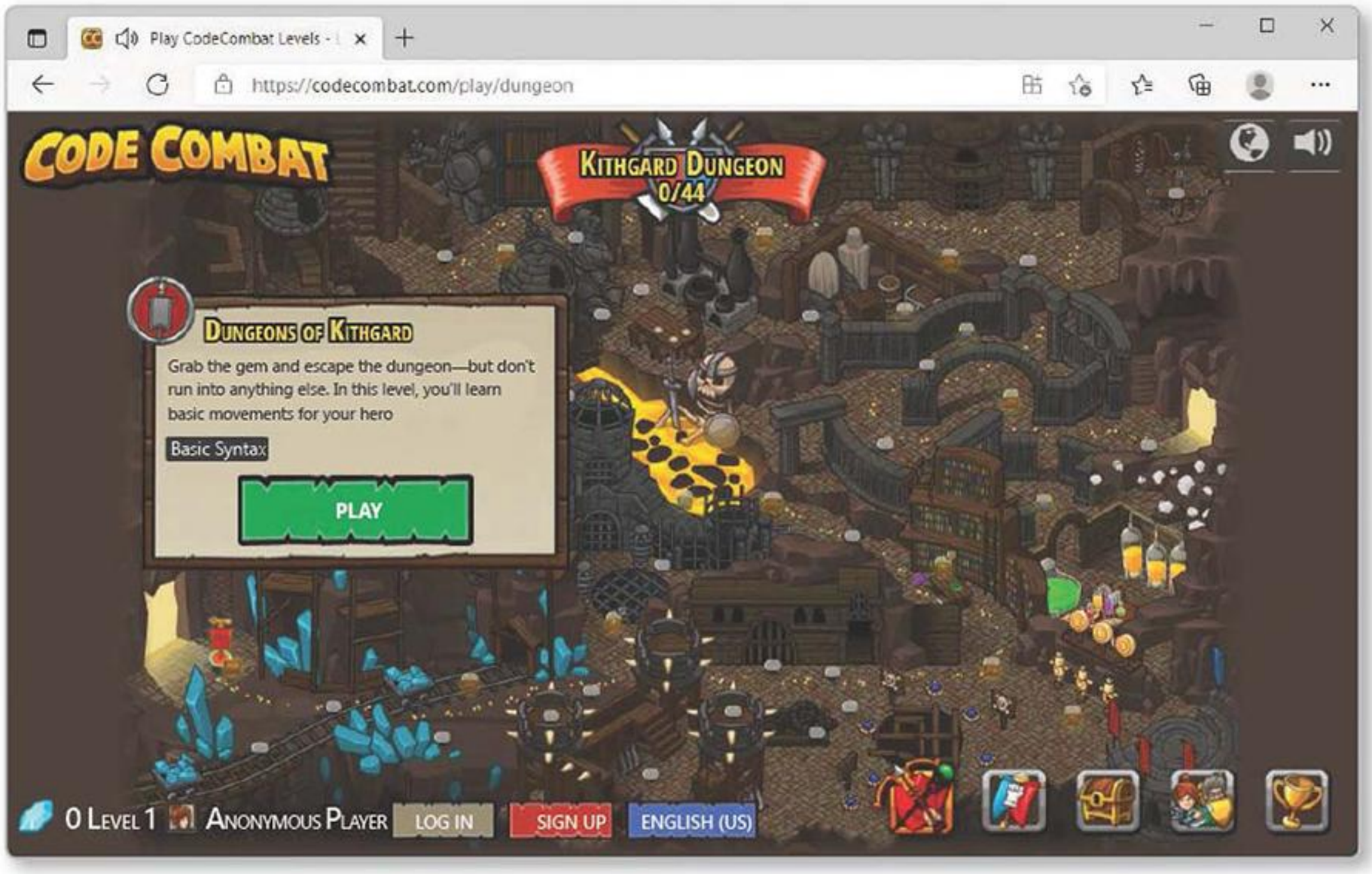
Step 4 Click on the **Play** button. The next screen will display that there are 54 levels in the game. A yellow colour arrow pointing on a red flag signifies the starting point of the game.



Step 5 Click on the **Red Flag**. A pop-up appears displaying the things to do while playing the game.

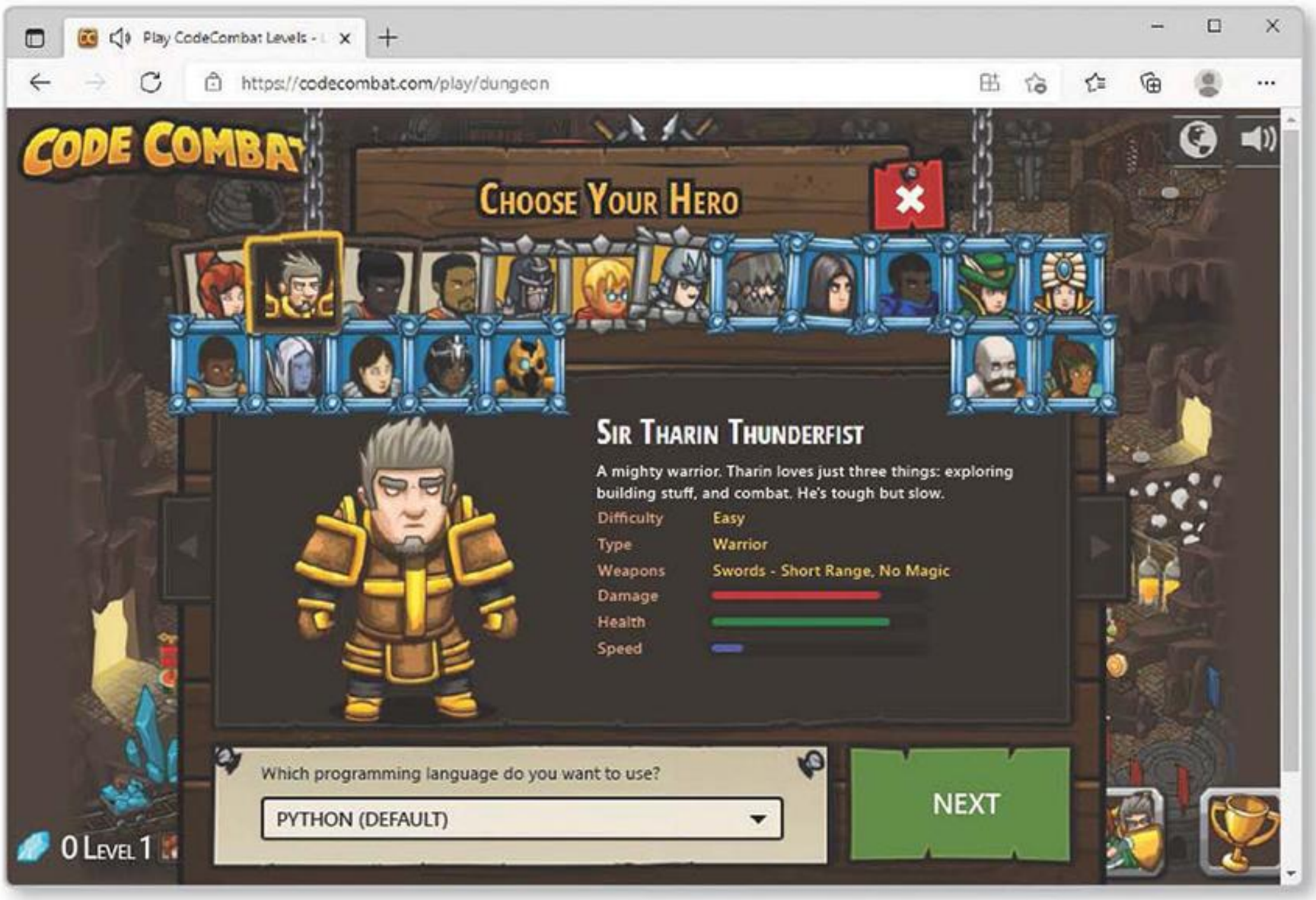


Step 6 Click on the **Play** button. The **Choose Your Hero** screen appears from where you need to choose the hero with which you want to play the game.

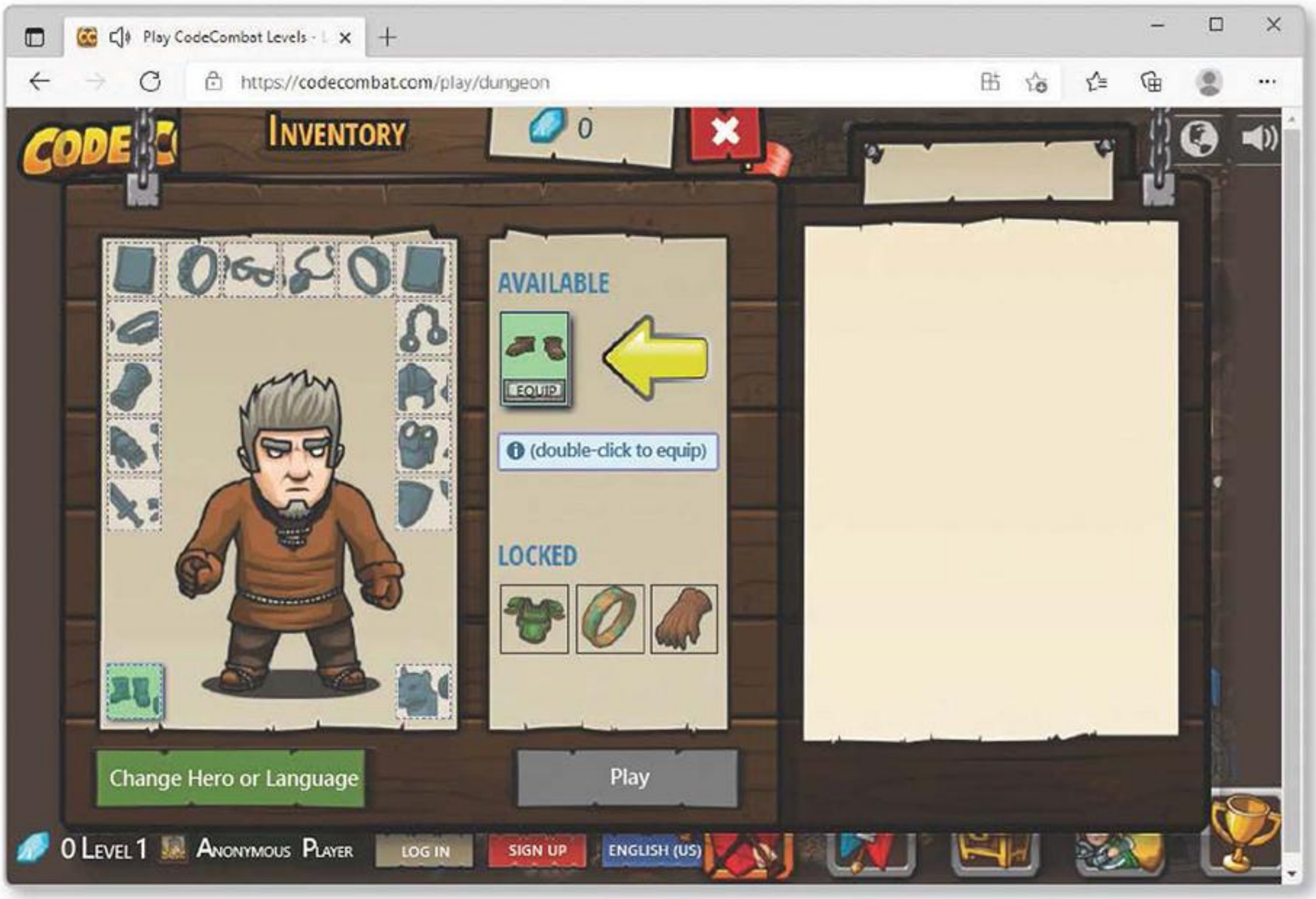


Step 7 Select the desired hero from the available heroes. Do not change the default programming language which is PYTHON by default. In this case, we have selected the **SIR THARIN THUNDERFIRST** hero.

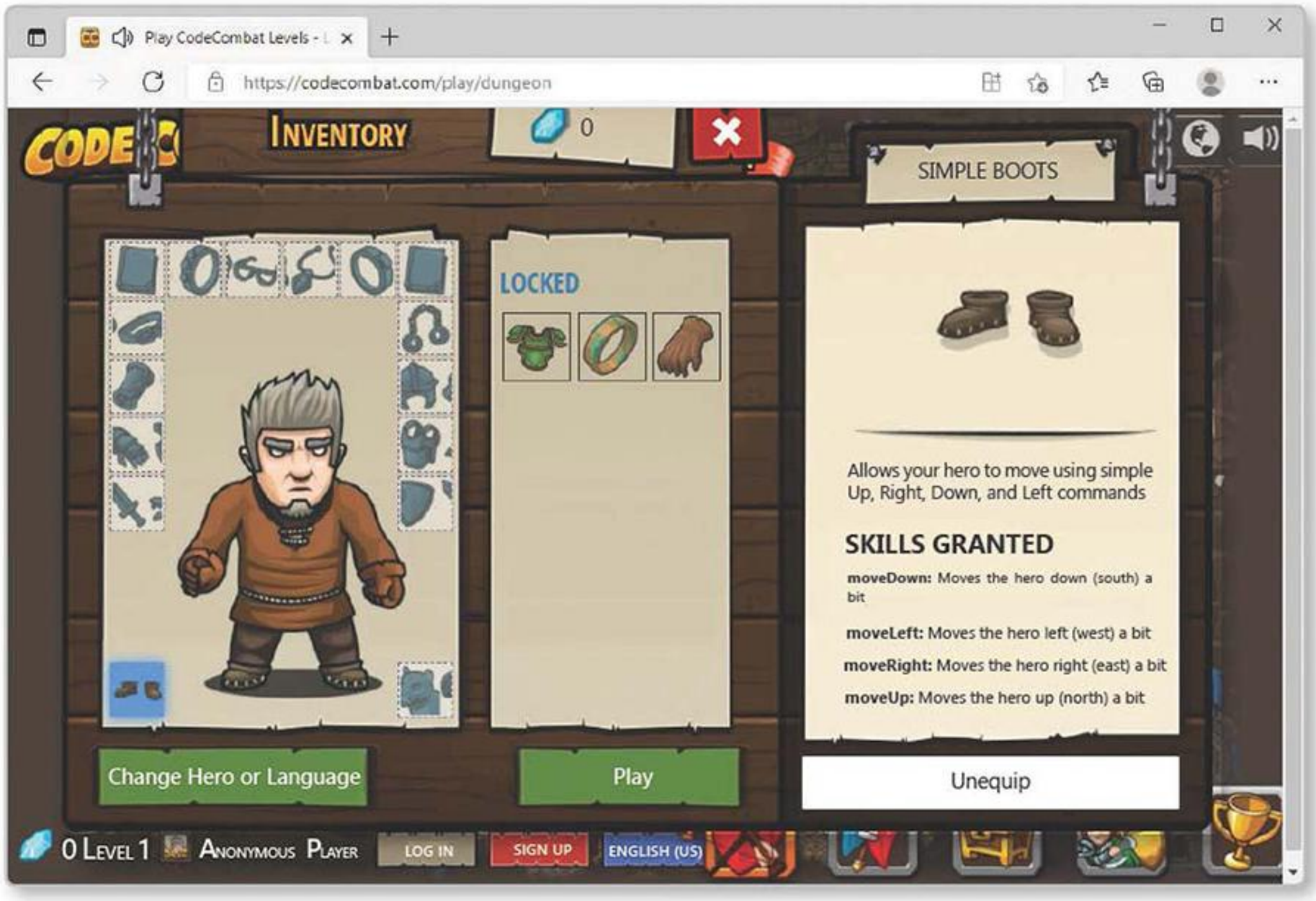
Step 8 Click on the **NEXT** button. The **Inventory** screen appears from where you can select different items and equipment to improve the performance of your hero.



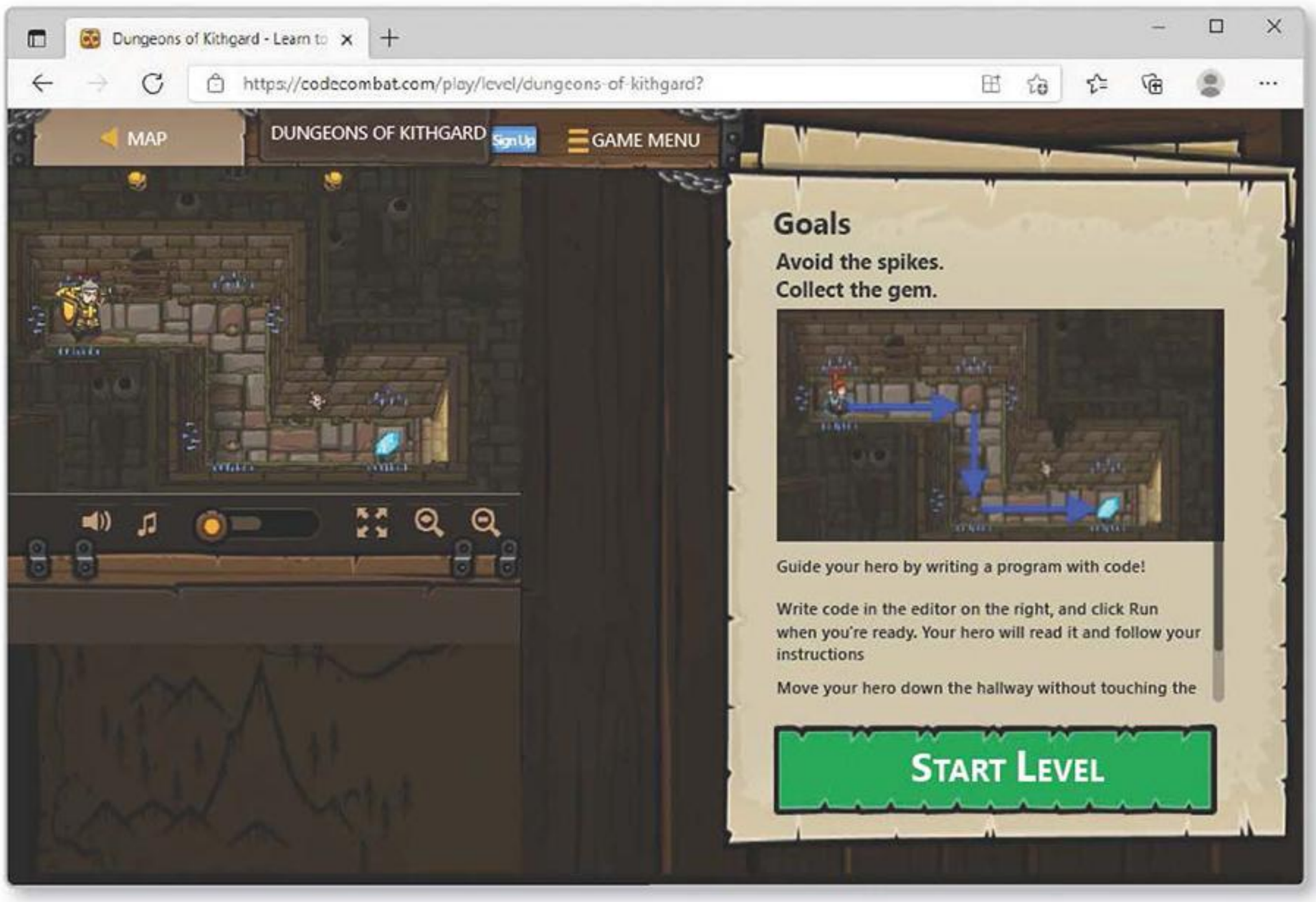
Step 9 Double-click on the equipment to select it.



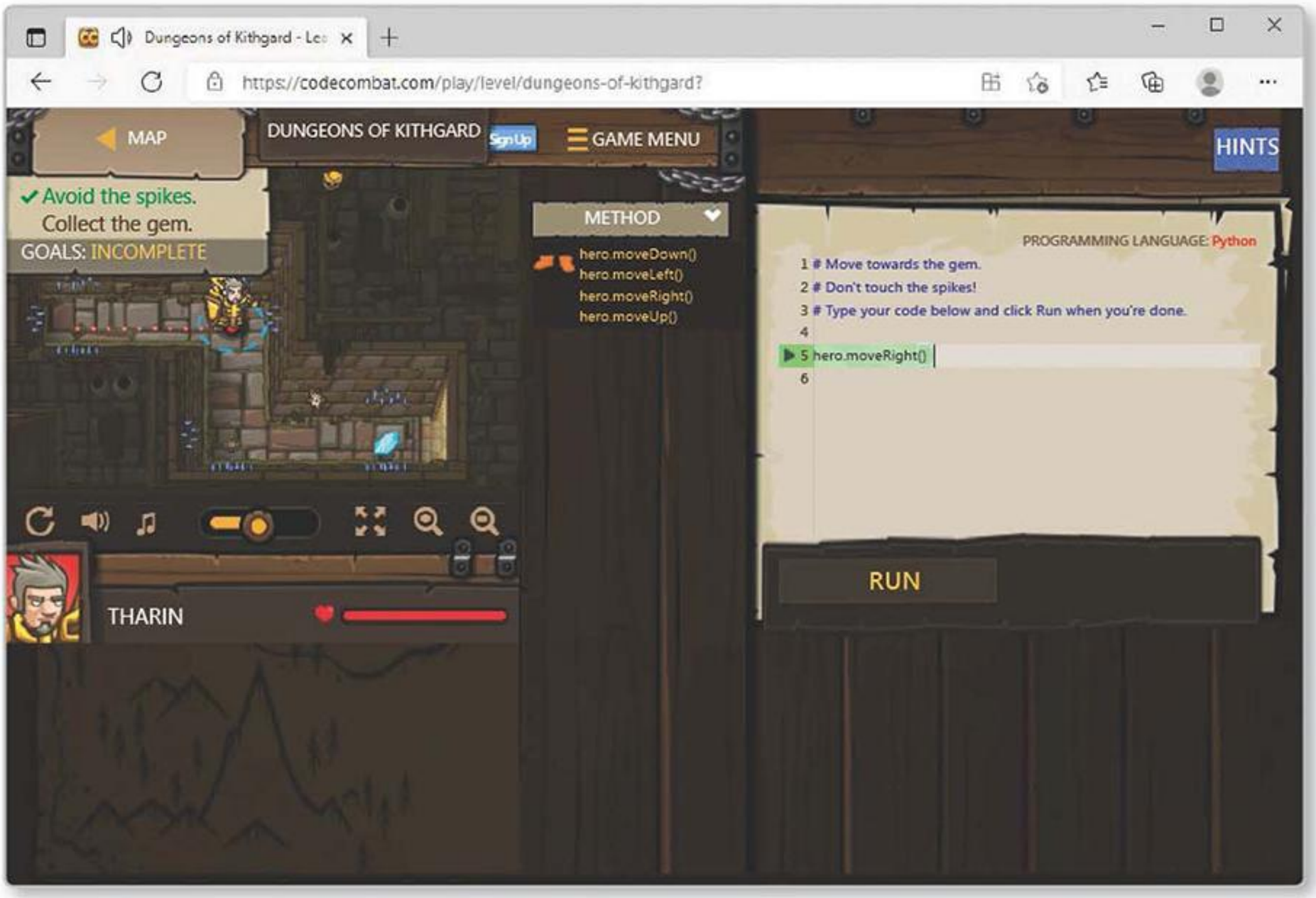
Step 10 After selecting the equipment, click on the **Play** button. The next screen shows the goals of the level.



Step 11 Click on the **START LEVEL** button. Next screen will allow you to type the code to move the hero.

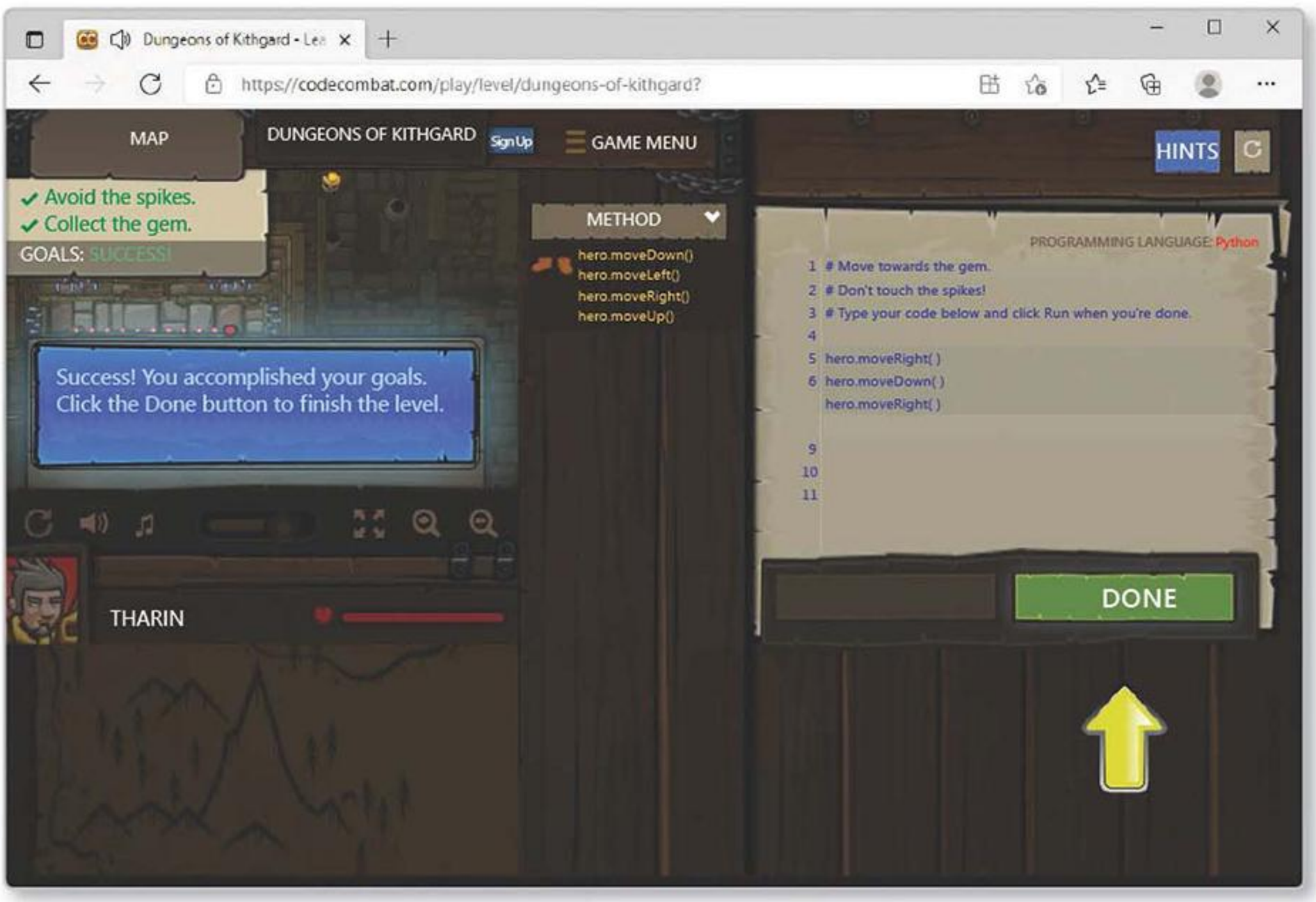


Step 12 Type the desired code and click on the **RUN** button.

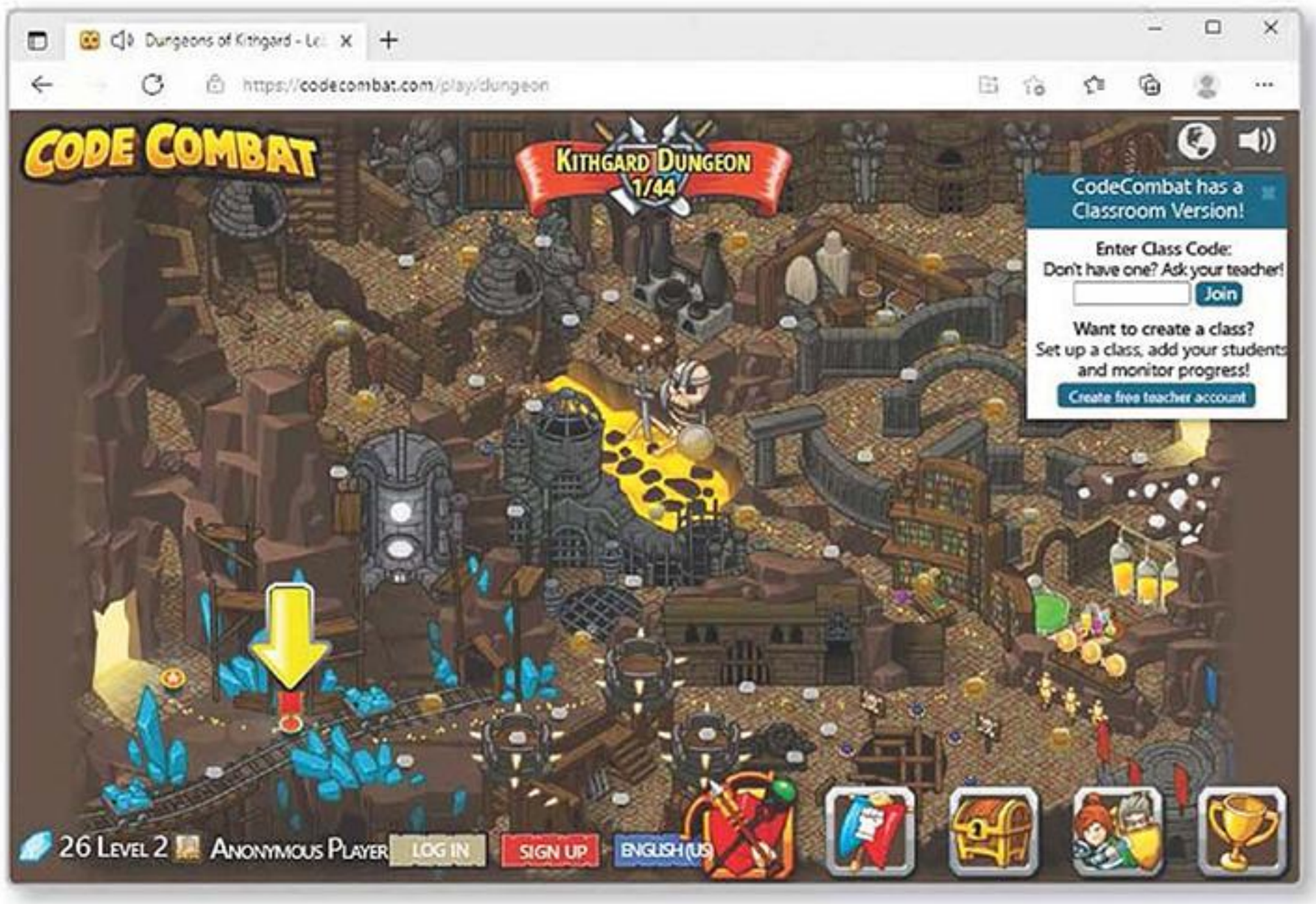


Step 13 Once you have completed the level, the **DONE** button appears.

Step 14 Click on the **DONE** button. The next screen will show that you are the winner.



Step 15 Click on the **CONTINUE** button to go to the next level.



Programming Language

A programming language is a formal language that specifies a set of instructions that can be used to produce various kinds of output. It has its own vocabulary and set of grammatical rules for instructing a computer to perform specific tasks.

For example, BASIC, Pascal, C, C++, Java, Haskell, Ruby, Python, etc. are some popular programming languages.

What is a computer program?

A computer program is a set of instructions written in any programming language that perform a specific task when executed by a computer. These instructions are executed by the computer's processor to achieve the desired output.

In this unit we will learn about Python as a programming language to write computer programs.

What is Python?

Python is a general-purpose, object-oriented, easy-to-learn and high-level programming language. *Guido van Rossum* designed Python and released it in 1991. He wanted to give a unique name to it so he named it after the famous BBC comedy TV show "Monty Python's Flying Circus".

Python as a language supports simple English-like statements, making it easy for programmers to learn and maintain. This is one important reason for its popularity.

Important Features of Python

Python is a very popular programming language. Let us study some of its important features to find out the reasons for its popularity:

- **High-Level Language:** Python is a high-level and general-purpose programming language which simplifies the process of developing a program. The code written in Python is more close to human language and away from machine language.

- **Easy to Learn and Use:** Python has simple, English-like statements that are easy to learn and use. Anyone can easily get used to its syntax and have expertise in it.
- **Expressive Language:** Python supports simple code that expresses itself in a few lines to do big and complicated tasks.
- **Free and Open Source:** Python code is developed under an OSI-approved open-source licence, which allows it to be downloaded free of cost from its official website, https://www.python.org. The code can be modified and distributed further, even for commercial purposes.
- **Cross-platform Language:** Python supports multiple platforms, like Windows, Linux, Mac, Raspberry Pi, etc., which means code written on one platform can easily run on another platform with little or no changes.
- **Interpreted Language:** Python uses an interpreter where the source code is converted and executed line by line at a time.
- **Object-Oriented Language:** Python supports the concept of classes and objects that make its code efficient and reusable with important features like polymorphism, inheritance, data encapsulation, etc.
- **Supports GUI:** Python supports a Graphical User Interface which makes its more user friendly and easy for the programmers to design code.
- **Large Standard Library:** Python has some built-in modules and packages for doing some standard and common tasks. These important libraries make it popular, especially in AI-based programs where we need to focus more on its use than its core design.
- **Portability and compatibility:** It refers to the ability of Python programs to run on various types of computer systems and operating systems without modification in the code.
- **Database and Scalable:** Python provides strong support for database interactions, allowing developers to efficiently connect, manipulate, and query databases with good support for the growth of applications in terms of performance, complexity, and data size.

Role of Python in Artificial Intelligence

Python is the most popular language for Artificial Intelligence based on the facts given below:

- **Built-in Libraries:** Many built-in modules and packages in Python reduce the development time and effort required to design code for artificial intelligence. There are Numpy for scientific computation, PyBrain for Python Machine Language, Scipy for advanced computing, Pandas for general-purpose data analysis, and many more.
- **Platform Independence:** Python has this versatile nature of running the code in any platform like Windows, MacOS, Linux, Unix, etc. Packages like PyInstaller can be used to prepare the code that can run on different platforms.
- **Extensible:** We can add low-level modules to the Python interpreter that help a programmer customise their tools in an efficient manner.
- **Availability of Data Analysis Tools:** Libraries like Matplotlib help data scientists build charts and histograms and plot them for easy comparison of data, which is important for creating data analysis reports with visual effects.
- **Community Support:** Python, being one of the most popular languages, has attracted a lot of developers to design online forums and online tutorials to provide assistance related to different types of programming in Python. This community support has been an important factor in using Python in AI design.

Applications of Python

Following are some applications of Python:

- **Used for Web and Internet Application Development:** Python has pre-built libraries and web frameworks like Pyramid, Django, and Flask, which are used for backend web development projects. Some standard libraries also support content design, database connectivity, and many Internet protocols like HTTP, SMTP, XML, etc.

- **Scientific and Numeric Calculation:** SciPy, Pandas, IPython are some of the built-in packages in Python that are used for scientific and numeric calculations.
- **Game Development:** PySoy (a 3D game engine that supports Python 3) and PyGame are two Python-based libraries used widely for game development. Most of the popular games like Frets on Fire, Disney's Toontown Online, etc. are designed using Python game libraries.
- **General-Purpose Software Development:** Python is used for all purpose software development. It also supports audio and video files that help in designing multimedia applications.
- **Database Access:** Python's strong support for database interactions allows developers to efficiently connect, manipulate, and query databases from within Python programs.
- **Business Application:** Python is widely used in various business applications due to its versatility, ease of use, and rich ecosystem of libraries and frameworks.

Installing Python

Windows does not come with Python installed by default. We need to download from the official website. The steps to download and install Python are:

1. Open the official website https://www.python.org/downloads. Depending on the operating system [Windows 32 Bit/64 Bit, Apple iOS] installed in your PC you can download Python. We are here taking the process of downloading for Windows 64 Bit OS.

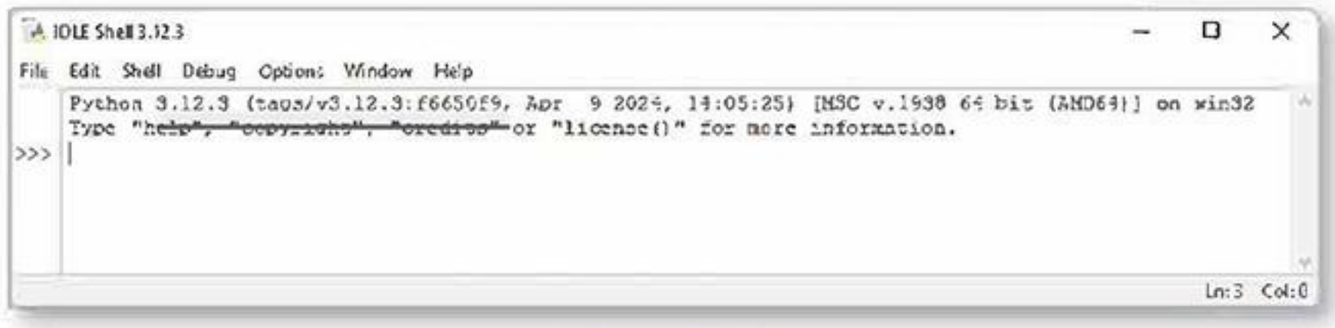
2. Click on the **Download Python** button. The installer file will start downloading.

Downloading Python

3. Click on the setup file to start installation. The **Python Setup** wizard appears.
4. Click on the **Install Now** button.

Python Setup Wizard

After the setup progress is complete, the message "Setup was successful" will be displayed. Now, Python is available in your Start menu and also as a shortcut on the desktop. When you open Python, the Python IDLE shell window opens. IDLE stands for Integrated Development and Learning Environment. It is a code editor that helps you write and execute Python programs in the editor itself.



Python IDLE

Brainy Fact

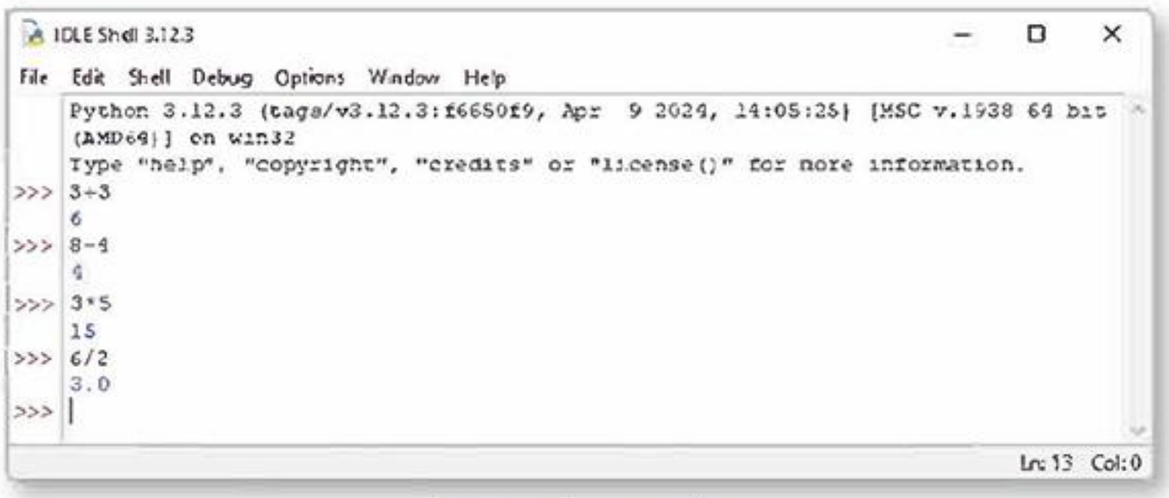
Many big companies, like Facebook, Google, NASA, MIT, Nokia, IBM, and many more, use Python for their products and services.

Working in Python

IDLE is the standard, most popular Python development environment. It allows you to write, edit, run, browse and debug the Python programs from a single interface.

We can interact with Python IDLE in two different modes:

- **Interactive Mode (Python IDLE-Shell Mode):** In this mode, you type one command at a time in front of the Python command prompt (>>>) and Python gives you the result based on the command given. It means you run code directly on shell mode accessed through the terminal of an operating system. This mode will not save your commands and outputs and should be used only when you want to play with small one-line instructions. You can also use the print( ) function to print the messages on the Shell window.



Interactive mode

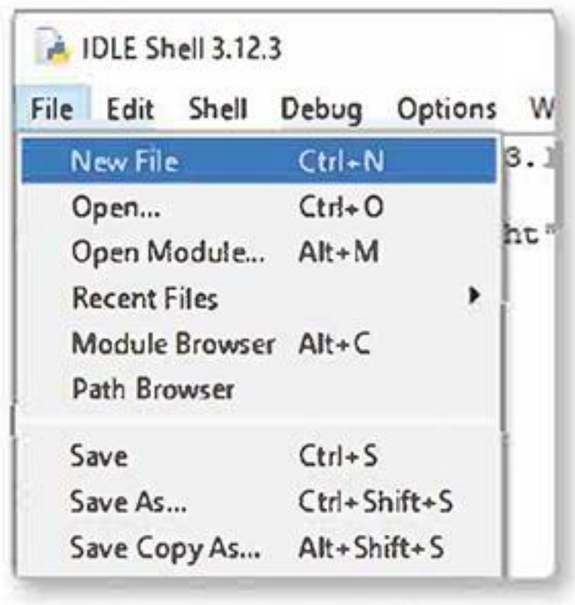
- **Script Mode (Editor):** In this mode, you save all your commands together in any text editor with the extension .py. When we run this text file .py then the output of the commands will be displayed in Shell mode.

  The steps to write and save a program are as follows:

  Step 1 Open the Python IDLE window.

  Step 2 Click on the **File** menu. A drop-down menu appears.

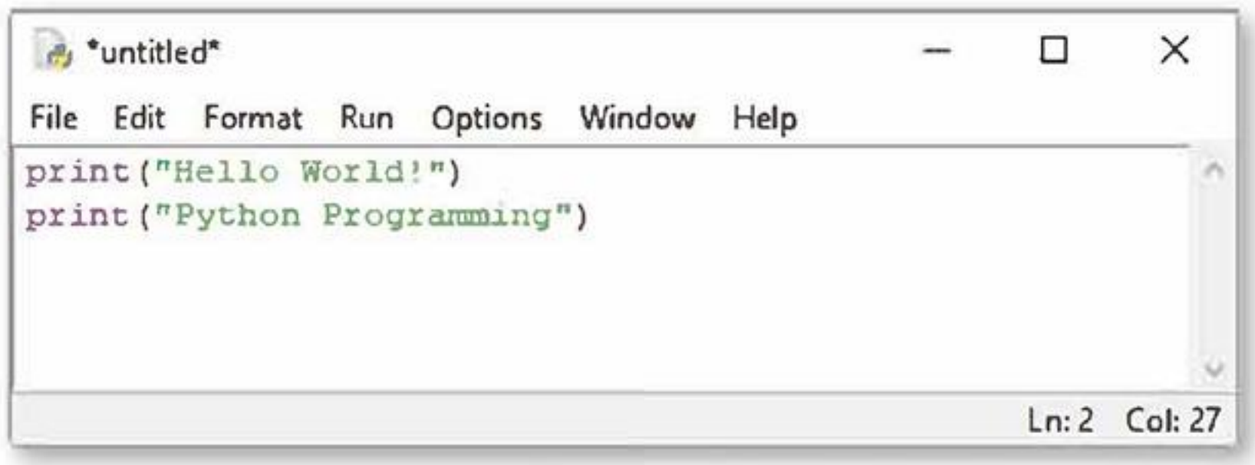
  Step 3 Click on the **New File** option.



The New File Option

A new editor window with a blank file will appear on the screen.

Step 4 Type the program code in Python window.

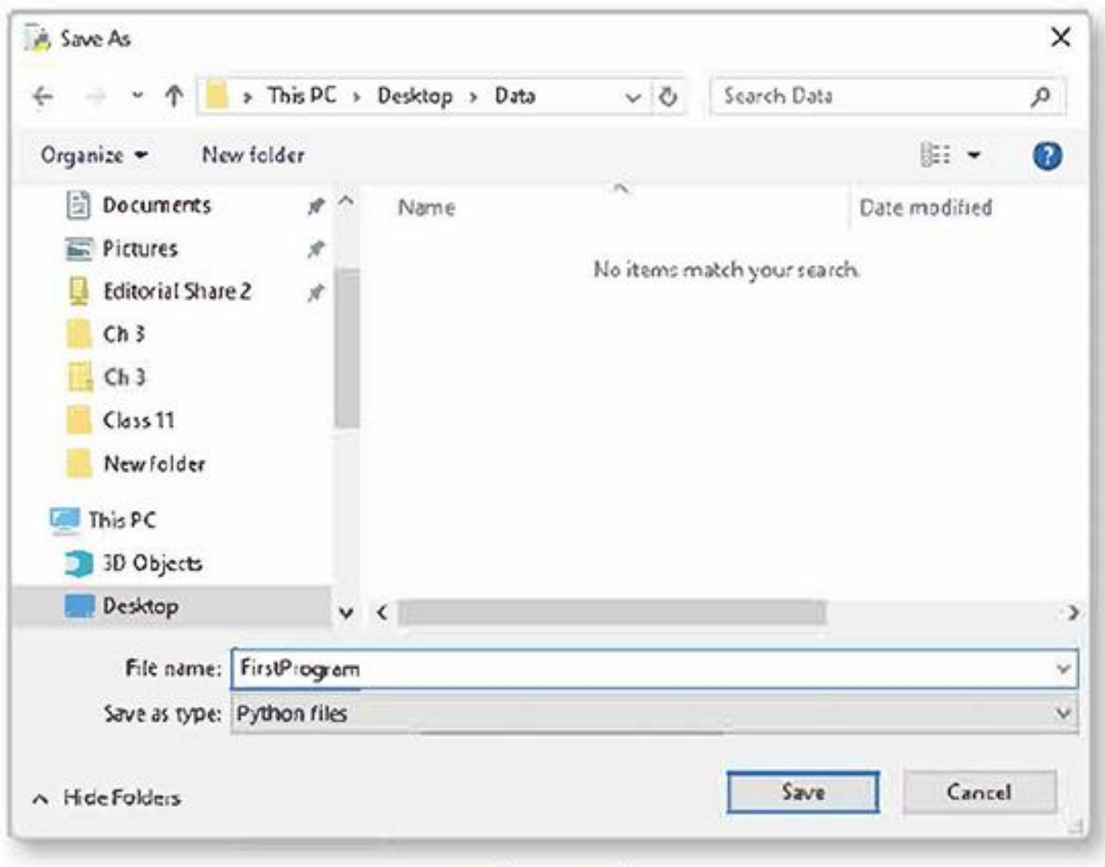


Write Code

Step 5 Click on the **File** → **Save** option from the menu bar. The **Save As** dialog box appears.

Step 6 Navigate the location where you want to save the file and enter the name of the file in the **File name** text box.

Step 7 Click on the **Save** button.



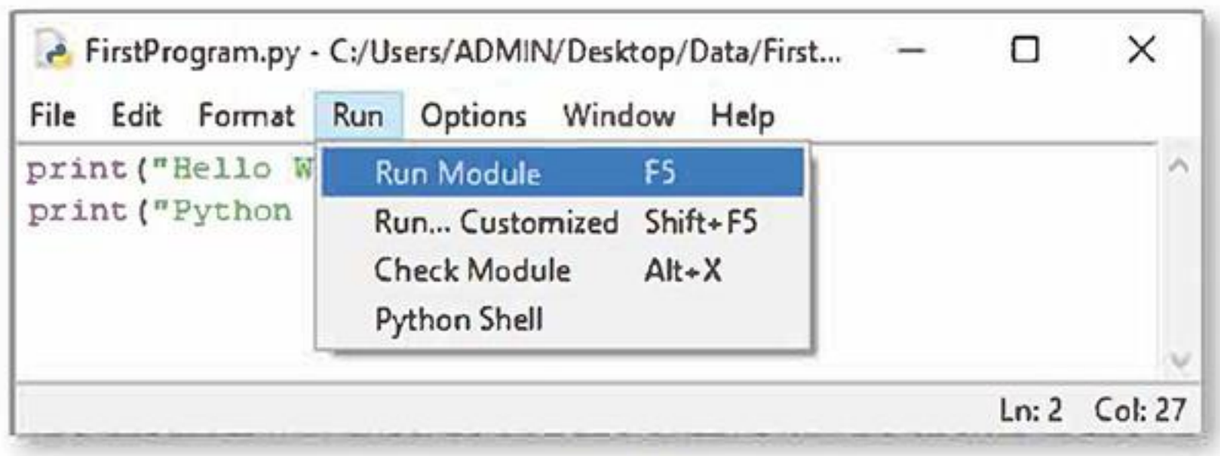
Saving a File

The file will be saved by the given name at the specified location.

Follow these steps to run a Python program:

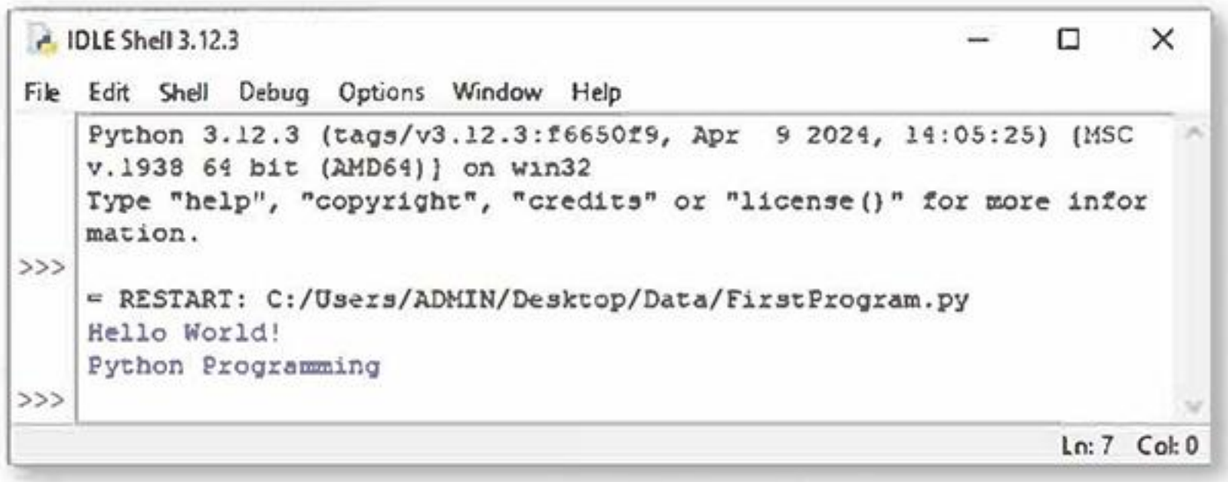
Step 1 Click on **Run** in the **Menu** bar.

Step 2 Click on the **Run Module** option. OR Press **F5 Function** key.



Selecting the Run Module option

The program will execute and the output will be shown in the **Shell** window.



Displaying the Result

Ai Task

#Experiential Learning

Colab—a free Jupyter notebook environment that runs entirely in the cloud allows you to write and execute Python code. Type http://colab.research.google.com to create your online Python notebooks which can be simultaneously edited by the members with whom you have shared your code in Colab. This process is similar to the way you edit documents in Google Docs, Google Sheets or Google Slides.

Python Character Set

A character set can be a set of valid characters. For example,

- Digits like 0, 1, 2, ... 9
- Letters in upper or lowercase like A to Z or a to z
- Special symbols like $, %, ^, &, *, (), @, !, etc.
- Whitespaces like spacebar, Tab key or Enter key
- ASCII or UNICODE characters like emoji symbols or other symbols with unique code.

Statements in Python

Instructions written in source code that are executed by a Python interpreter are called statements. There are three types of statements in Python which are simple statements, multiline statements and multiple statements. Let us learn about them in detail.

Simple Statements

By default, the end of a statement is done by pressing an **Enter** key. Each statement is written on a new line.

```
a=5 # is a simple statement where variable 'a' is created with value 5.
c=a + b
```

Multiline Statements

We can make a statement that extends over multiple lines. There are number of ways of making multiline statement. Few are given below:

1.
```
a = 4 + 5 +\
    6 + 7 +\
    8 + 9
```
\backslash helps you fit long calculations on multiple lines.

2.
```
flowers =['Rose','Lily',
          'Sunflower','Hebiscus']
```

3.
```
marks =(10,25,16,
        18,28,30)
```

Multiple Statements

Multiple statements represent more than one statement in a single line. This can be done by separating the statements using **semicolon (;).**

```
a = 5; b = 10; c = a + b; print(c)
```

Tokens

Tokens are the smallest meaningful unit of a program. Python supports the following tokens:

- Keywords
- Identifiers
- Literals
- Punctuators
- Operators

Let us discuss each of these in detail.

Keywords

Keywords in Python are predefined and reserved words with special meanings and purposes and are not allowed to be used as identifiers. We can see the list of the reserved keywords by giving the following command at the Python command prompt:

```
>>>import keyword
>>>keyword.kwlist
```

Following is the list of keywords displayed by running the above commands:

```
['False', 'None', 'True', 'and', 'as', 'assert', 'async', 'await', 'break', 'class',
'continue', 'def', 'del', 'elif', 'else', 'except', 'finally', 'for', 'from', 'global',
'if', 'import', 'in', 'is', 'lambda', 'nonlocal', 'not', 'or', 'pass', 'raise',
'return', 'try', 'while', 'with', 'yield']
```

Identifiers (Names)

Identifiers are the user-defined names of variables, list, dictionary, tuples, classes, etc. They identify an element in Python.

Naming the identifiers follows the given rules:

- It can contain alphabets (uppercase, lowercase), numbers or underscore(_).
- Must begin with a letter (a-z, A-Z) or an underscore (_).
- No special characters like $, period(.), space, etc. are allowed.
- It should not be a Python keyword.
- It is case-sensitive (uppercase and lowercase letters are different).

Example of invalid identifiers are:

First name : Spaces not allowed

Last&Name : Cannot have special character

9thclass : Cannot begin with number

else : Keyword not allowed

Examples of valid identifiers are:

Myclass, class9, Address, address, first_name, city, student_id, data123

Literals

It is defined as any data stored in a variable. It is a constant whose value never change during the program execution. Different types of literals in Python are as follows:

- **String literals:** They are sequence of words enclosed in single, double, or triple quotes. For example,

  "Hello"

  'Python'

- **Numeric literals:** They can be integer, float or complex. For example,

  14

  20.5

  2+5j

- **Boolean literals:** They can be True or False. For example,

  True

- **None literals:** Only None is a special literal. It means something not yet created.

Punctuators

Punctuators are special symbols used in Python to organise statements and expressions. Most commonly used punctuators in Python are:

' " # \ () {} [] @ , : . =

Operators

Operators are special symbols used to perform mathematical, logical and relational operations on variables and values. The variables or values on which the operators work are called operands. Some commonly used operators in Python are arithmetic operators, relational operators, logical operators and augmented assignment operators.

Arithmetic Operators

Arithmetic operators are used to perform mathematical operations on variables and values.

Following arithmetic operators are provided by Python:

Name	Symbol	Purpose	Example	Output
Addition	+	Adds two values.	2 + 4 2.0 + 4 "hi" + "all"	6 6.0 "hiall"
Subtraction	–	Subtracts second value form the first value.	6 – 2 6.0 – 2	4 4.0
Multiplication	*	Multiplies two values.	2 * 3 1.5 * 2 "Hi" * 3	6 3.0 'HiHiHi'
Division	/	Divides the first number with the second number.	4 / 2 6.0 / 2 6 / 2.0 11 / 2	2.0 3.0 3.0 5.5
Remainder or Modulus	%	Returns the remainder of a division.	5 % 2 16 % 11	1 5
Exponential	**	Second number raised to the power of the first number.	5 ** 2 1.5 ** 2	25 2.25
Floor division	//	Divides the first number with the second number and returns the whole number adjusted left to the number line.	11 // 2 -11 // 2 13 // 4 -13 // 4	5 –6 3 –4

Brainy Fact

- If we use + (Addition) operator with strings, it concatenates two values.
- If we use * (Multiplication) operator with String and integer value, it repeats string value same number of times.

Relational Operators

Relational operators or comparison operators compare the values given on both the side of the operators and returns the boolean value either True or False.

Following relational operators are provided by Python:

Name	Symbol	Purpose	Example	Output
Equal to	==	Returns True if both the values are same otherwise False.	a = 5 b = 10 a == b	False
Not equal to	!=	Returns True if both the values are different otherwise False.	a = 5 b = 10 a != b	True
Greater than	>	Returns True if first value is greater than second value otherwise False.	a = 5 b = 10 a > b	False
Less than	<	Returns True if the first value is less than second value otherwise False.	a = 5 b = 10 a < b "abc" > "aBc" "67" > "621" (string value are compared using ASCII code)	True True True
Greater than or equal to	>=	Returns True if the first value is greater than or equals to the second value otherwise False.	a = 5 b = 10 a >= b	False
Less than or equal to	<=	Returns True if the first value is less than or equals to the second value otherwise False.	a = 5 b = 10 a <= b	True

Brainy Fact

Python uses ASCII/Unicode character set. ASCII Stands for "American Standard Code for Information Interchange." It is a character encoding standard that uses numerical codes to represent characters in uppercase and lowercase, numbers and punctuation symbols. ASCII values of capital letters A–Z are **65** to **90**, small letters are **97** to **122** and numbers **0** to **9** are **48** to **57**.

Logical Operators

Logical operators are used to combine one or more conditional statements and returns either True or False based on the evaluation of the conditions. Following logical operators are provided by Python:

Name	Symbol	Purpose	Example	Output
AND	and	Returns True if both the operands are True otherwise False.	5 < 10 and 2 < 5	True
OR	or	Returns True if either the operands is True otherwise False.	5 > 10 or 2 < 5	True
NOT	not	Returns True if the operand is False. or vice versa. It reverses the result.	not(5 > 10 or 2 < 5) not(10 < 5) not(True)	False True False

Brainy Fact

In case of OR operator, the second condition is checked only if the first is False otherwise it ignores the second operand.

Assignment Operator

Assignment operator is used to assign a value to a variable or a constant. = sign is used as an assignment operator in Python. For example,

```
rollno = 12
myname = "Alisha"
mymarks = 92.5
```

Augmented Assignment Operators

Augmented assignment operators are those operators which take the value of the operand on the right side, perform an operation and assign the result to the operand on the left side. These operators are also known as shorthand assignment operators. For example, if a=10 then a+=5 is the same as a=a+5.

Python provides the following augmented assignment operators:

Symbol	Purpose	Example	Output
+=	Adds first and then assigns the result to the left-hand side operand.	a = 5 b = 10 a += b a += 5	15 20
-=	Subtracts first and then assigns the result to the left-hand side operand.	a = 5 b = 10 a -= b	-5
*=	Multiplies first and then assigns the result to the left-hand side operand.	a = 5 a *= 5	25
/=	Divides first and then assigns the result to the left-hand side operand.	b = 10 b /= 5	2.0

Symbol	Purpose	Example	Output
//=	Floor division first and then assigns the result to the left-hand side operand.	a = 5 b = 10 b //= a	2
%=	Remainder of a number first and then assigns the result to the left-hand side operand.	a = 5 b = 10 a %= b	5
**=	Exponential of a number first and then assigns the result to the left-hand side operand.	a = 2 b = 4 a **= b	16

Ai Reboot

1. What is the use of the ** operator?

2. Define the relational operators.

3. Give an example to use **= operator.

4. Run the given statements in interactive mode and write the output generated:

```
True+1
45+bool(-11)
2+False+bool(0)
12-10+bool(10)
True+"hello"
```

Operator Precedence

An expression is made up of values, variables, operators and functions. For example,

x-5+6 is an expression

To evaluate an expression with multiple operators, Python follows an order of precedence. This order can be altered by writing an expression within parentheses.

The order of precedence in descending order is listed below:

Order of Precedence	Operators
1	()
2	**
3	*/%//
4	+-
5	<= < > >=
6	== !=
7	= %= /= //= -= += *= **=
8	not, and, or

If an expression contains two or more operators with the same precedence, then the order of evaluation is from left to right, except for exponential (**) which is always from right to left. For example,

- 10 – 2 + 3 – 3 will be evaluated from left to right as + and – has the same order of precedence. So, the answer will be 10 – 2 will be 8 + 3 will be 11 – 3 will be 8.
- 2 ** 3 ** 2 will always be evaluated from right to left. It will be calculated as 2 ** (3 ** 2) and not as (2 ** 3) ** 2. So, the answer will be 512.

Ai Task

#Problem Solving & Logical Reasoning

Solve the following expressions using the operator precedence:

- 10 + 20 / 5 – 3 * 2 _____
- 5 * (10 + 5) + 10 – 5 _____

Variables

A variable is a name given to a memory location to hold a specific value. It is just like a container that can hold any type of data that can be changed later in the program.

Variable has:

- A **name** that follows the identifier naming conventions and is case-sensitive.
- A **value** that can be integer, float, string, boolean, etc.

Unlike other programming languages, variables in Python are not created before use. They are created automatically when a value is assigned to them by using the assignment operator (=).

A variable assigned a value of one type can be re-assigned a new value of a different type, as shown below:

```
>>>a = 20
>>>a
20
>>>a = "hello"
>>>a
'hello'
```

There are different ways of assigning values to variables in Python:

- **Method1:** Assigning different values to different variables on different lines.

```
>>>a = 5
>>>b = 10.5
>>>c = "hello"
```

- **Method2:** Assigning different values to different variables on same line.

```
>>>a = 5; b = 10.5; c = "hello"
```

OR

```
>>>a, b, c = 5, 10.5, "hello"
```

- **Method3:** Assigning same value to different variables on same line.

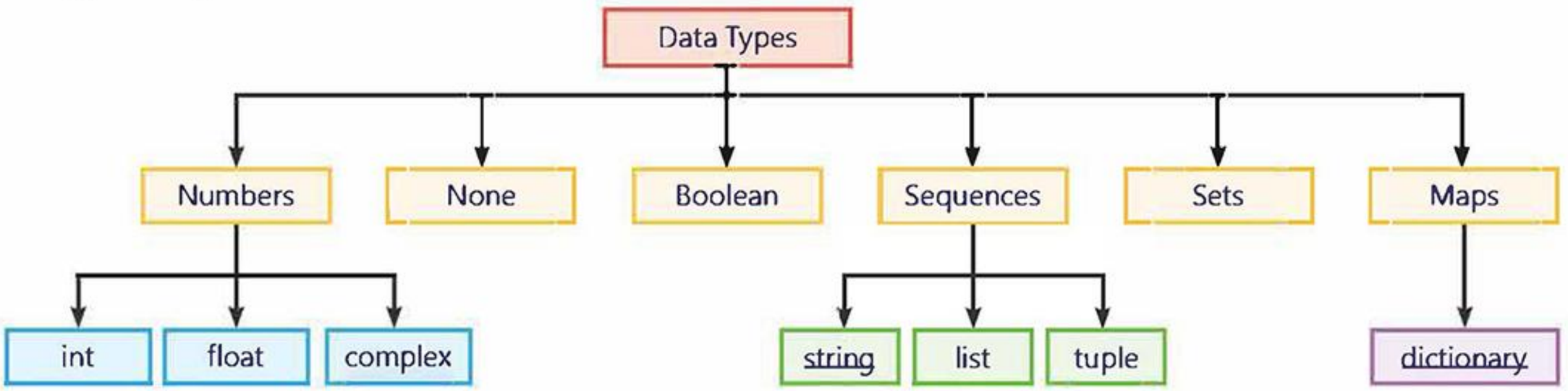
```
>>>a = b = c = 10
```

Brainy Fact

Python is a case-sensitive language where uppercase and lowercase characters have different meanings. Name and name are two different variables.

Data Types

Data types specify the kind of a value a variable can store. It helps us to identify the kind of operation that can be performed on that specific data type. Every value in Python has a data type. Some of the standard built-in data types of Python are:



- **Numbers:** Data with a numeric value falls into this category. It can be integer, float and complex. Python will automatically convert a number from one type to another if needed. Following are some number types:
  - **Integer:** Integers are whole numbers (+ve, -ve or 0) with no fractions or decimal value. Range of an integer in Python can be from -2147483648 to 2147483647, and long integer has unlimited range subject to available memory. For example, 10, 124, 4567, 7812568751.
  - **Float:** It is a real number with floating point representation. For example, 15.5 and 12.0. It can also be represented using the exponent notation E. For example, 1E5 is 100000.
  - **Complex:** It is made up of a real number and an imaginary number. For example, 3+2j where 3 is a real number, 2 is an imaginary number, and j is the imaginary unit.
- **None:** This is a **special data type** with NULL or nothing/no value. It does not mean 0, False or empty. It is represented by None.
- **Boolean:** It is a data type with two built-in values: **True** or **False**. It is used in logical evaluation. A True value represents 1 while a False represents 0.
- **Sequence:** It is a collection of data stored under a common name. Each value is referred by its index number. It can be mutable or non-mutable. There are three types of data as sequence in Python:
  - **String:** It is an ordered sequence of UNICODE characters enclosed in single or double quotes. Multi-line strings can be created using triple quotes (single or double). The quotes are not part of string. They only tell the computer where the string constant begins and ends. Its length is dependent on the available memory. It can also be empty where we have just empty quotes with no value. For example,

```
" "
"Hello"
'Python'
"I love 'Python'"
```

A multiline string in Python is a string that spans across multiple lines. It allows you to create a string that contains line breaks and multiple paragraphs without using special characters like \n for newline. Multiline strings are defined by enclosing the text within triple quotes, either single (''') or double (""") quotes. For example,

```
'''It is
an interesting
    Language'''
```

* **Lists:** It is a sequence of heterogeneous values arranged as elements and are referred by an index number. These values are separated by comma and are enclosed in square brackets [ ]. They are mutable data types as the values of these data types can be changed by the user after creation. For example,

```
list_of_names=["Amit","Shweta","Peter","Zoya"]
Marks=[89,92,93,78,89]
class9=[101,"Neha",89.5,102,"Shushil",92]
```

* **Tuples:** It is a sequence of heterogeneous values arranged as elements and are referred by an index number. These values are separated by comma and are enclosed in circular brackets ( ). They are immutable as the values of these data types cannot be changed by the user after creation.

```
mytuple=("Amit","Shweta","Peter","Zoya")
Marks=(89,92,93,78,89)
class9=(101,"Neha",89.5,102,"Shushil",92)
```

- **Set:** A set is a collection of unique elements that is both mutable and unordered. Sets are defined using curly brackets {} with elements separated by commas. Each element in a set must be unique. Sets are commonly used for tasks that involve mathematical operations like union, intersection, and difference. For example,
  mySet = {21, 52, 33, 54, 95}
- **Dictionary:** In Python, a dictionary is a data type that stores a collection of Key : Value pairs. Each key is unique within the dictionary, and it maps to a corresponding value. Dictionary is represented by curly braces {} with each pair separated by a colon (:). Dictionaries are mutable, meaning they can be modified after creation. For example, person = {'name': 'Yash', 'Department': 'Sales', 'city': 'Delhi'}

Data Type Conversion

The process of converting value of one data type to another is called type conversion or type casting. This is useful when you need to perform operations involving mixed types.

Python supports two types of type conversion:

1. Implicit Type Conversion
2. Explicit Type Conversion

1. **Implicit Type Conversion:** In implicit type conversion, when Python encounters mixed data types, it automatically converts one data type to another data type to avoid data loss and ensure compatibility. This process doesn't require any user involvement.

```
# Example of implicit type conversion
a = 5                              # Integer
b = 2.0                           # Float
# Adding an integer and a float
result = a + b
```

```
print(result)                # Output: 7.0
print(type(result))    # Output: <class 'float'>
```

2. **Explicit Type Conversion:** Explicit type conversion, also known as type casting, is performed by the programmer using predefined functions to convert one data type to another. This is necessary when you need to ensure that a specific type is used for an operation or when Python does not automatically convert the types.

Common Functions for Explicit Type Conversion

- `int()`: Converts a value to an integer.
- `float()`: Converts a value to a float.
- `str()`: Converts a value to a string.
- `bool()`: Converts a value to a boolean.
- `list(), tuple(), set(), etc.`: Convert to respective data structures.

Examples:

```
>>> float(12)
12.0
>>> int(15.5)
15
>>> str(12)
    '12'
>>> int(True)
    1
>>> bool(0)
    False
```

You can get the data type of any object by using `type( )` function. For example,

```
>>> type(10)
<class 'int'>
>>> type("abc")
<class 'str'>
>>> type(14.5)
<class 'float'>
```

Comments in Python

Comments are used to increase the readability of the code. We use them to give a proper understanding of the code in simple English statements. They are completely ignored by the Python interpreter. It is always a good practice to add comments in your code so that if anybody in the future wishes to understand or modify your code, then through comments it will be easy to interpret the instructions. There are two different ways of writing comments in Python. Let us learn about them in detail.

Single Line Comment

Single line comment starts with hash symbol # followed by the text to be written as a comment that lasts until the end of the line.

For example,

```
# assigning a value to a variable
      num1 = 10
      num2 = 20
# calculating the average
      (num1 + num2) / 2
```

Multiple Line Comments

When we add up comments which occupy two or more lines then we begin the comment with either 3 times single quotes ''' or double quotes """, followed by text on multiple lines and end with single quotes ''' or double quotes """ to mark the end of the comment. For example,

```
"""This program calculates
    the average of
    two numbers stored in
    two different variables"""
    a = 10
    b = 20
    c = (a + b) / 2
```

The print() Function

The `print()` function is used to print an output on the screen. It converts the expressions into a string before writing to the screen. Syntax to use the `print( )` function is:

```
print(object(s), sep = separator, end = end)
```

Where,

- `object` can be one or more separated by comma and it can be a variable, literal, expression. An object will be converted to string before printed.
- `sep` parameter specifies the separator between the items you want to print. By default, the separator is a space. You can change this to any string you want.
- `end` parameter allows you to specify what to print at the end of the output. By default, end is set to a newline character ('\n'), which means each print statement will end with a new line.

Following are some of the examples of the `print( )` function:

Commands	Output
`print("hello")`	hello
`print("hello", "friends")`	hello friends
`print("hello" + "friends")` `(This is concatenation of string using "+" operator)`	hellofriends
`print("hello", "friends", sep="$")`	hello$friends

Commands	Output
`print("hello", "friends", sep="$", end="!")`	hello$friends!
`print("hello", "friends", end="!")`	hello friends!

`print("hello")`
`print()`
`print("friends")`
	hello
	
	friends

`print("hello", end="%")` `print("friends")`	hello%friends
`print("hello", "friends", "welcome", sep="#", end="@")`	hello#friends#welcome@
`print("I am in class", 9)`	I am in class 9

`a = 5`
`b = 10`
`print("Sum of two numbers is " + str(a + b))`
	
	Sum of two numbers is 15

`age = 14` `print("I am ", age, " years old")`	 I am 14 years old

NOTE: sep and end are always the last two parameters after the objects in the print statements. However both may have interchange positions.

```
print(10,20 ,sep="+",end="!")
```

OR

```
print(10,20, end="!",sep="+")
```

Output in both the cases will be same as both the statements are interpreted as same.

The input() Function

The `input()` function is used to take input from the user. When this statement executes then the flow of the program stops and waits with the cursor blinking for the user to enter a value. The input given by the user is always a string value in Python.

The syntax to use the `input()` function is:

```
input(prompt)
```

Where prompt is a string that works as a message for the user at the time of input. For example,

```
name = input("enter your name: ")
print(name)
```

When the preceding statement executes, it will ask to enter a name. When you enter the name and press the Enter key, the entered name will be displayed on the screen:

```
enter your name: Chirag
Chirag
```

Let us take another example:

```
a = input("Enter first number: ") #line 1
```

```
b = input("Enter second number: ") #line 2
c = a + b
print("The sum of", a ,"and", b ,"is", c)
```

If we execute the preceding code and enter 4 and 5 as the values of the first and second numbers, then the answer will be 45 instead of 9. This is because Python considers every input value as a string. If we want to perform mathematical calculations, then we have to convert the taken input explicitly by using `int( )` or `float( )` functions. The syntax to convert an input value into an integer or float type is:

```
a = int(input(prompt))                    # to convert into integer
b = float(input(prompt))                  # to convert into float
```

Let us create the preceding program again by using the `int( )` function.

```
a = int(input("Enter first number: ")) #line 1
b = int(input("Enter second number: ")) #line 2
c = a + b
print("The sum of", a ,"and", b ,"is", c)
```

Now, the program will display the correct output as 9.

Errors in Python

Sometimes, while writing a code we might make mistakes. These mistakes are called errors. There are three kinds of errors which a programmer encounters in Python: syntax error, logical error and runtime error. Let us learn about them in detail.

Syntax Error

Syntax refers to the rules for writing code in the Python language. A syntax error occurs when these rules are violated. This is the most common type of error made by a programmer. Syntax errors can result from typing errors, incorrect indentation, or providing incorrect arguments to a function. When Python encounters a syntax error, it cannot interpret the instruction and will raise an error. In IDLE, syntax errors are highlighted by an arrow, indicating the line where the error occurred. You can then go to that line to rectify the error. Some examples of syntax errors include:

```
a + b = c
SyntaxError: cannot assign to operator

myname = Arshia
SyntaxError: EOL while scanning string literal

a = 5
b = 10
  c = a + b
SyntaxError: unexpected indent

print("Python"))
SyntaxError: unmatched ')'
```

Logical Error

This kind of error is difficult to find since the program will run correctly but the desired output is not achieved. This happens if we give a wrong formula for the calculation to be done, write wrong logic for the problem to be solved through the code.

For example,

To calculate the average:

```
p = marks1 + marks2 / 2 #instead of (marks1+marks2) / 2
```

Preceding code produces a wrong output due to the logical error in formula. Let us take another example. To find the perimeter of rectangle,

```
p = 2 * l + b                #instead of p = 2 * (l + b)
```

Runtime Error

Runtime errors occur during the execution of a program and can result from various issues such as incorrect input or output, undefined object errors, or division by zero errors. These errors can halt the program's execution unexpectedly, making them challenging to debug.

Example of runtime error is:

```
a = int(input("enter first number"))
b = int(input("enter second number"))
c = a / b
```

If a = 5 and b = 0, then it will display:

```
ZeroDivisionError: division by zero
```

Control Statements

As you know that a program is a set of instructions given to a computer to do a specific task. The order of execution of these instructions controls the flow of a program. There are three important ways to control the flow of a program which are interpreted by any programming language in a structured manner. These are:

- Sequential Statements
- Selection Statements
- Iterative Statements

Let us learn about these in detail.

Sequential Statements

A step-by-step process of executing code is called sequential flow of control. This is the default flow of execution of a program. It means that the computer will run the code one line at a time starting from line 1, followed by line 2 and so on until it reaches the last line of the program.

Let us take an example of making a mango smoothie. The steps will be:

1. Put mango pieces in a Mixer jar
2. Add sugar
3. Add milk
4. Churn the mixer jar
5. Pour in a glass

Let us do some more examples:

Program 1: Input the first name and last name from the user and display the full name.

Algorithm

Step 1 Start

Step 2 Input FirstName, LastName

Step 3 FullName= FirstName + LastName

Step 4 Display FullName

Step 5 Stop

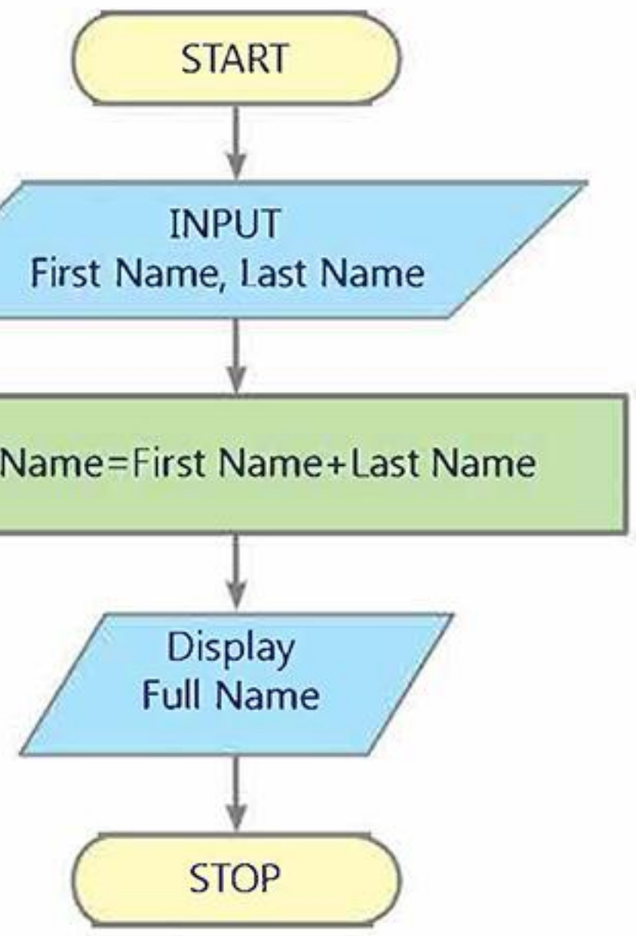
Source Code:

```
FirstName=input("Enter your First Name: ")
LastName=input("Enter your Last Name: ")
FullName=FirstName+" "+LastName
print("Hello! "+FullName+" Welcome to the World of Python")
```

Output:

```
Enter your First Name: Megha
Enter your Last Name: Sharma
Hello! Megha Sharma Welcome to the World of Python
```

Flowchart



Program 2: Input the length and breadth of a rectangle. Calculate the area and perimeter.

Algorithm

Step 1 Start

Step 2 Input Length, Breadth

Step 3 Area=Length × Breadth

Step 4 Perimeter= 2(Length + Breadth)

Step 5 Display "Area is ", Area

Step 6 Display "Perimeter is ", Perimeter

Step 7 Stop

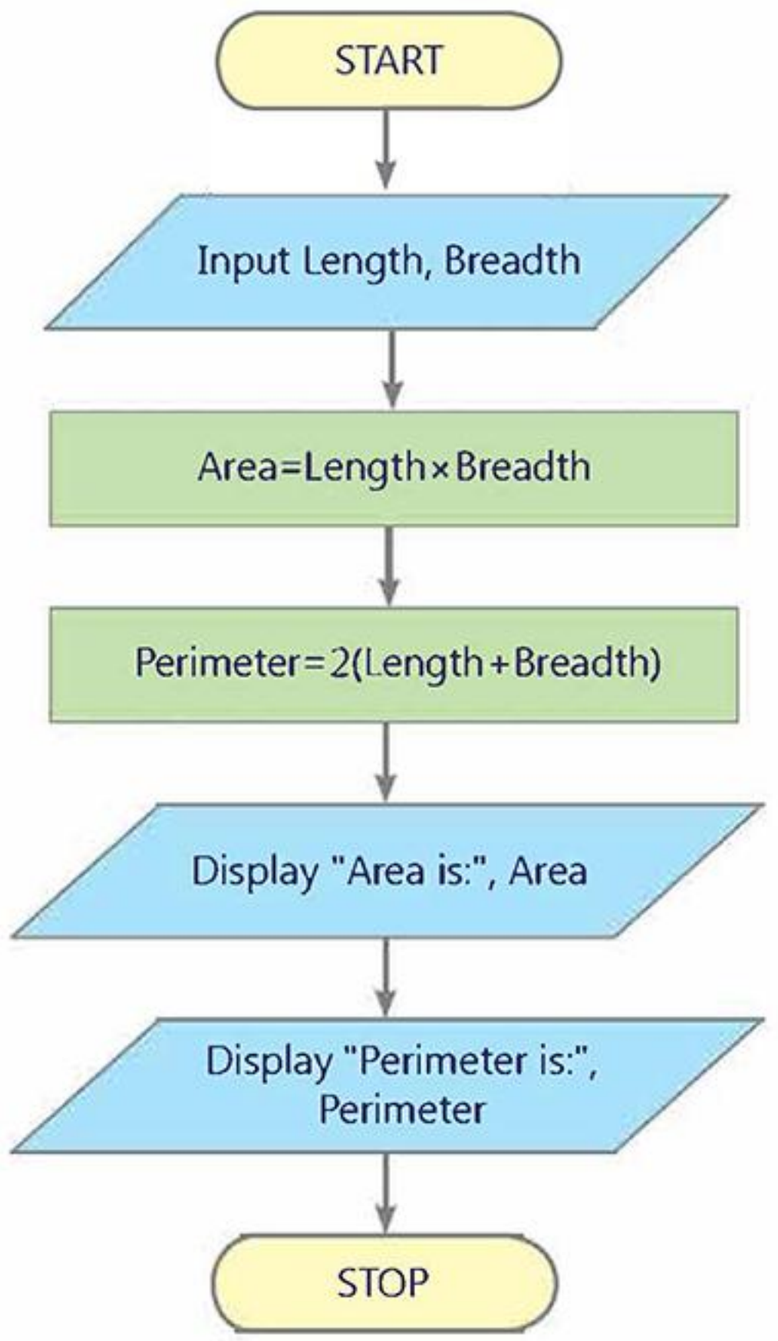
Source Code:

```
Length= int(input('Enter Length:'))
Breadth = int(input('Enter Breadth:'))
Area= Length*Breadth
Perimeter=2*(Length + Breadth)
print("Area is:", Area)
print("Perimeter is:", Perimeter)
```

Output:

```
Enter Length: 25
Enter Breadth: 63
Area is: 1575
Perimeter is: 176
```

Flowchart



Ai Task

#Experiential Learning
#Coding & Computational Thinking

1. Type "import this" in your Python IDLE, and you will find a poem written by Tim Peters, a major contributor to the Python community.

2. Input a radius of a circle. Calculate the area and perimeter of circle.

Selection Statements

In Python,

- Selection flow of control is achieved through conditional statements.
- In the conditional/selection statements, flow of control is changed based on a condition. We specify the condition in the program, which evaluates to either 'True' or 'False'.
- If condition is 'True' then the block of statement written for 'True' will be executed, and if the condition is 'False' then the block of statements for 'False' will be executed.
- Conditional statements are also called branching statements because a program decides which statement to execute based on the result of the evaluated condition.
- A block is identified by using an indentation (minimum 1 space). Ensure that all statements in one block are indented at the same level.
- Python mainly provides three types of conditional statements—`if`, `if...else` and `if...elif...else` statements.

Let us learn about them in detail.

The if Statement

We use the `if` statement to do conditional programming. Condition with the `if` statement can also be written within the parenthesis ( ). However, it is optional to use parenthesis. It is mandatory to specify colon (:) after writing a condition with the `if` statement. The number of statements (also called as a Block) written within `if` statement can be of any size. A statement or block of statement will be executed only when the condition is 'True'. If the condition is 'False' then nothing happens.

The syntax of the `if` is as follows:

```
if (condition):
    statements
```

Where,

- `if` is a keyword.
- `condition` can be any relational or logical expression.
- `statements` are always indented can be single or a block.

Program 3: To input the percentage of a student and award "Certificate of Excellence" if the student gets more than 80%.

Algorithm

Step 1 Start

Step 2 Input Percentage

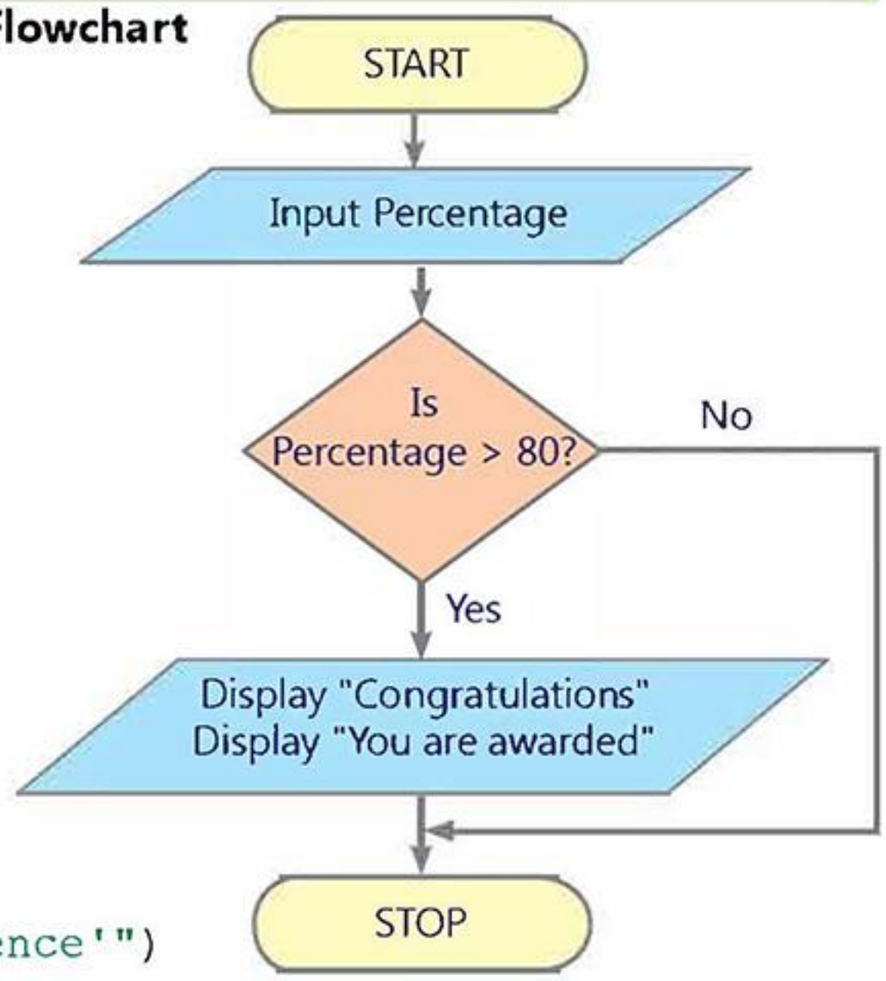
Step 3 if Percentage is more than 80 then

Display "Congratulations"

Display "You are awarded - 'Certificate of Excellence'"

Step 4 Stop

Flowchart



Source Code:

```
percent=int(input("Enter your percentage:"))
if percent>80:
    print("Congratulations")
    print("You are awarded- 'Certificate of Excellence'")
```

Output:

```
Enter your percentage:89
Congratulations
You are awarded- 'Certificate of Excellence'
```

Program 4: To input day of the week and in case it is SUNDAY then extra cookie as a reward point to be given with the order.

Algorithm

Step 1 Start

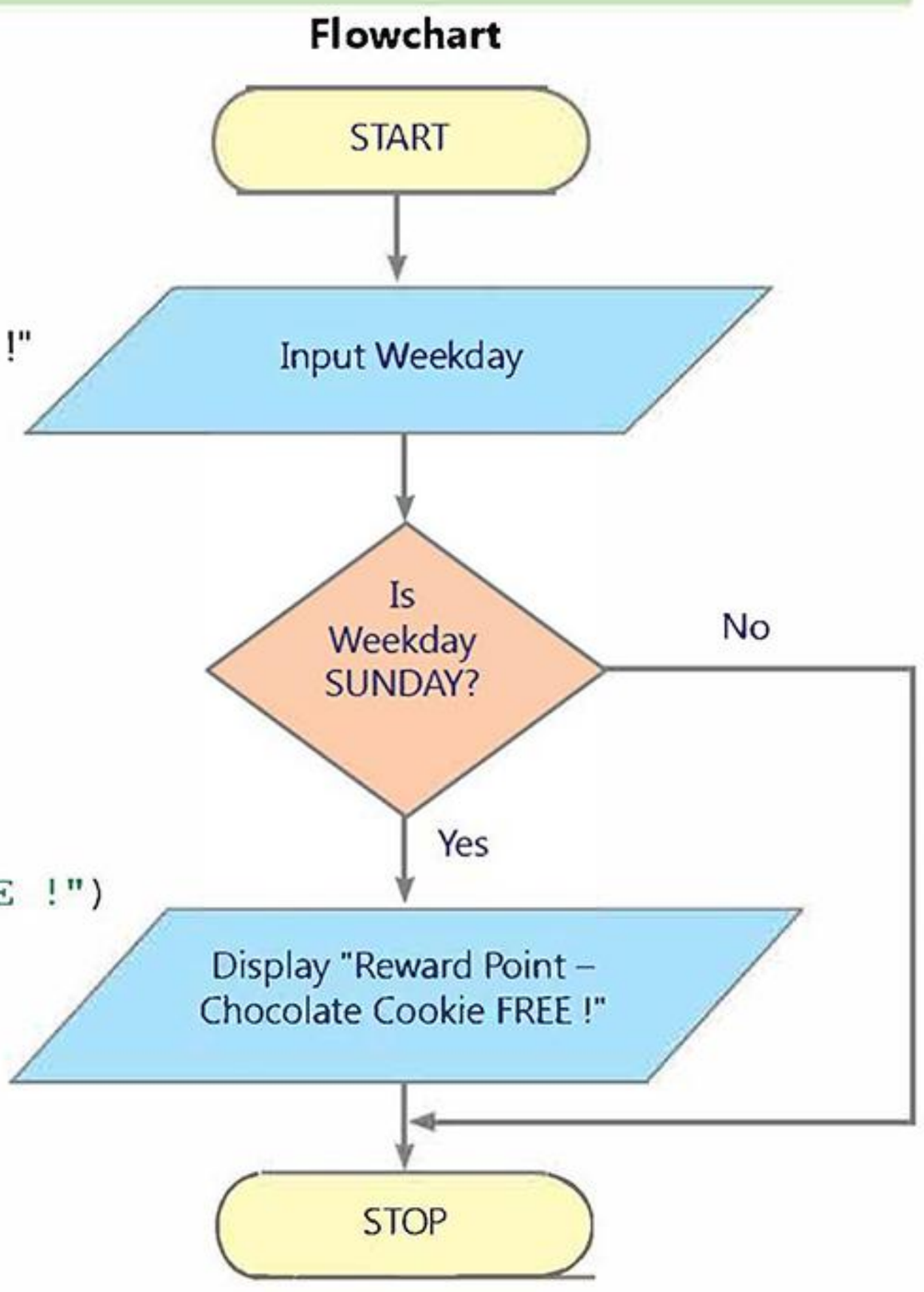
Step 2 Input weekday

Step 3 if weekday is same as "SUNDAY" then

Display " Reward point - Chocolate Cookie FREE !"

Step 4 Stop

Flowchart



Source Code:

```
weekday=input("Enter day of the week:")
if weekday=="SUNDAY":
    print("Reward Point - Chocolate Cookie FREE !")
```

Output:

```
Enter day of the week : SUNDAY
Reward Point - Chocolate Cookie FREE !
```

The if...else Statement

When the condition is 'True' then the statements indented just below the `if` statement will be executed and if the condition is 'False' then the statements indented just below the `else` statement will be executed. The `else` statement is optional and there can be only one `else` statement in one `if` block. The syntax to use the `if...else` statement is:

```
if (condition):
     Statements for True
else:
     Statements for False
```

Where,

- `if` and `else` are keywords.
- `condition` can be any relation or logical expression.
- `statements` are always indented and can be single or a block.

Program 5: To input two numbers and display the bigger of the two numbers.

Algorithm

Step 1 Start

Step 2 Input N1, N2

Step 3 if N1 is greater than N2 then

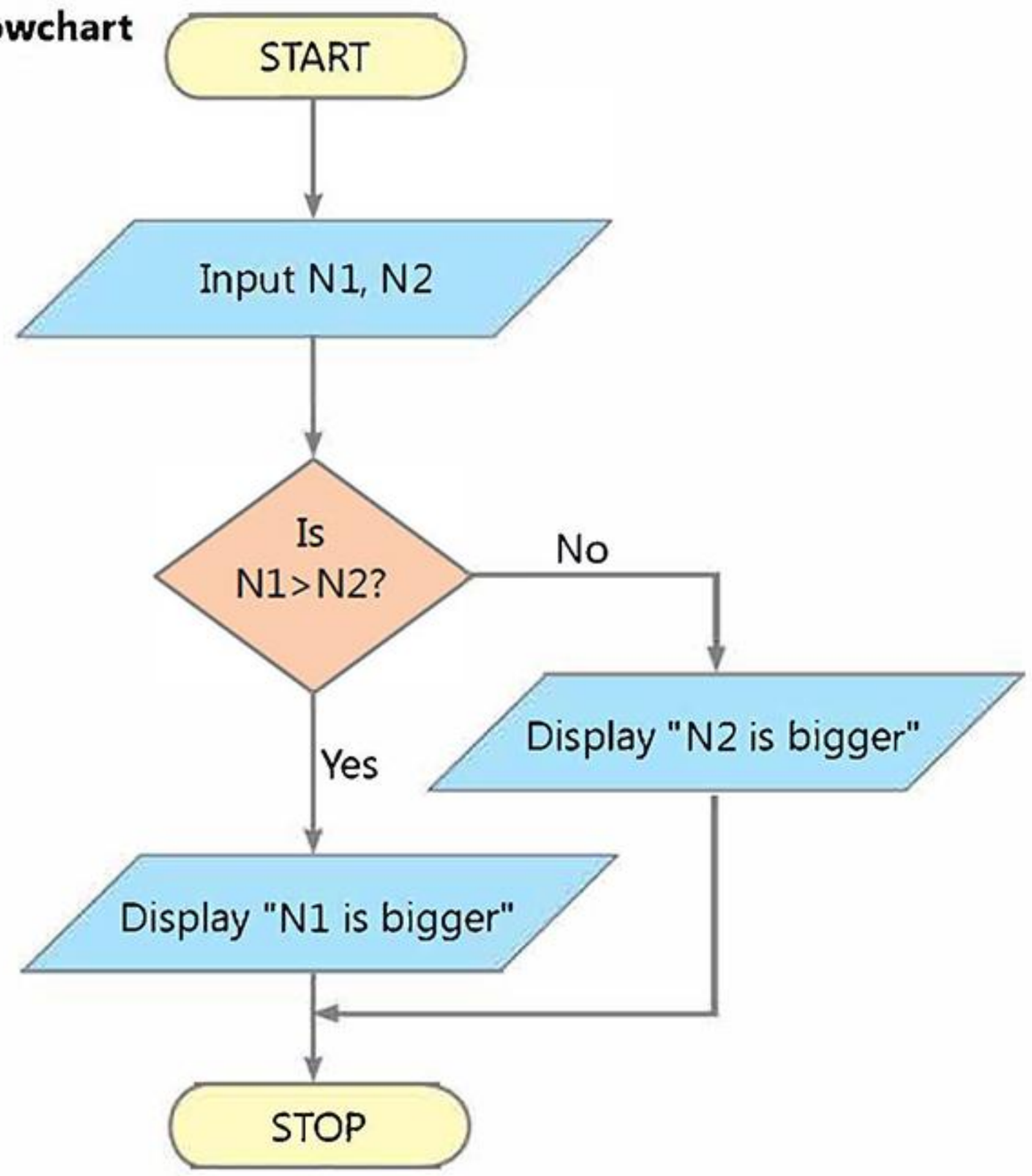
Display "N1 is bigger"

Step 4 else

Display "N2 is bigger"

Step 5 Stop

Flowchart



Source Code:

```
N1=int(input("Enter First Number:"))
N2=int(input("Enter Second Number:"))
if N1>N2:
    print(N1," is bigger ")
else:
    print(N2,"is bigger ")
```

Output:

```
Enter First Number:34
Enter Second Number:45
45 is bigger
```

Program 6: To input a number and display whether it is even or odd.

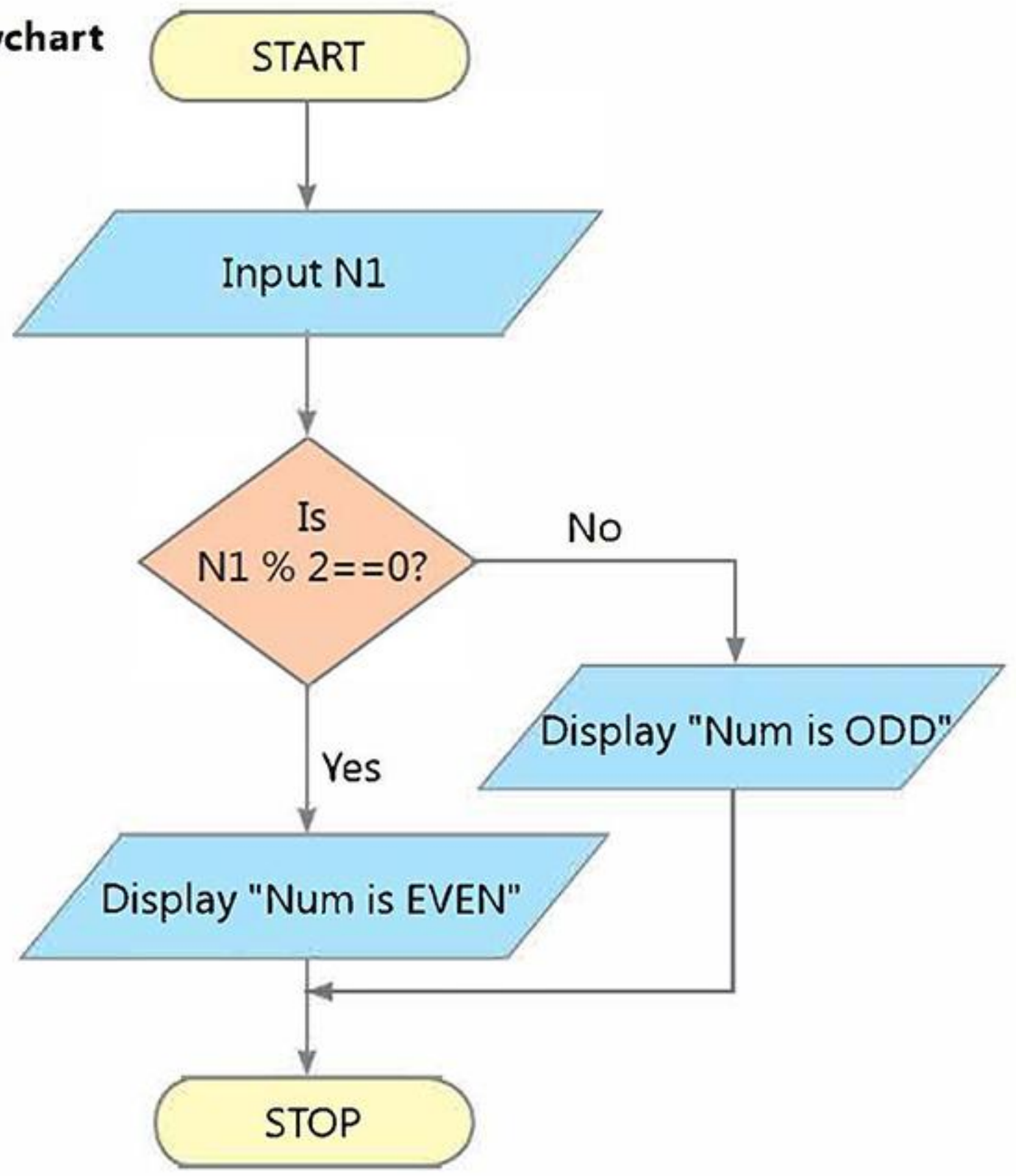
Algorithm

Step 1 Start

Step 2 Input Num

Step 3 if Num is divisible by 2 then
Display "Num is EVEN"
Step 4 else
Display "Num is ODD"
Step 5 Stop

Flowchart



Source Code:

```
Num=int(input("Enter a Number:"))
if Num%2==0:
    print(Num," is EVEN")
else:
    print(Num," is ODD")
```

Output:

```
Enter a number: 23
23 is ODD
```

The if...elif...else Statement

When there are multiple conditions in a program then it is handled by using `elif` statement. It means if the previous condition is not 'True' then try this condition written next to `elif`. If one condition is 'True' then the statements below it will be executed and the rest of the conditions given using `elif` will be ignored. In case all the conditions written with `elif` are not 'True', then the statements written just below the `else` statement will be executed. The syntax of the `if...elif...else` statement is as follows:

```
if (condition1):
   Statements 1
elif (condition2):
   Statements 2
elif (condition3):
   Statements 3
...
else:
   Statements executed when all above conditions are False
```

Where

- `if`, `else`, `elif` are keywords.
- `condition1`, `condition2` and `condition3`, ..., can be any expression.
- `statements1`, `statements2` and `statements3` are always indented can be single or a block of statements.

Program 7: To input two numbers and an operator from the user. Display the result calculated based on the operator entered.

Algorithm

Step 1 Start

Step 2 Input N1, N2, op

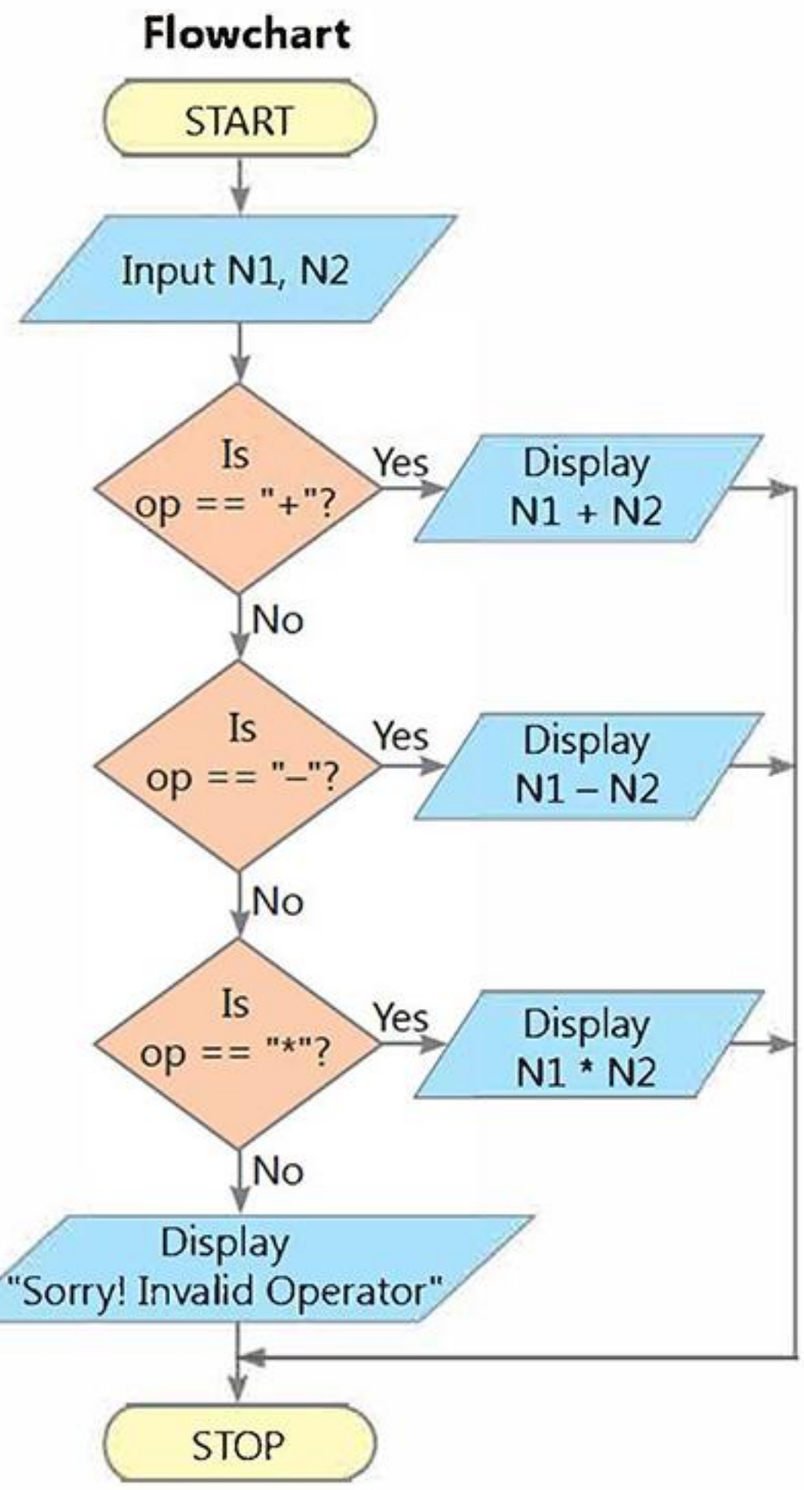
Step 3 if op is same as that of '+' then
    Display N1+N2

Step 4 else, if op is same as that of '-' then
    Display N1-N2

Step 5 else, if op is same as that of '*' then
    Display N1*N2

Step 6 else
    Display "Sorry! Invalid Operator"

Step 7 Stop



Source Code:

```
N1=int(input("Enter First Number:"))
N2=int(input("Enter Second Number:"))
op=input("Enter an operator(+, -, * only):")
if op=="+":
    print("The addition is", N1+N2)
elif op=="-":
    print("The subtraction is", N1-N2)
elif op=="*":
    print("The multiplication is", N1*N2)
else:
    print("Sorry! Invalid Operator")
```

Output:

```
Enter First Number: 5
Enter Second Number: 4
Enter an operator(+,-,* only): *
The multipication is 20
```

Program 8: To input a number and check whether the number is positive of negative.

Algorithm

Step 1 Start

Step 2 Input Num

Step 3 if Num is same as 0:
    Display "You entered zero"

Step 4 else, if Num is greater than 0:
    Display "You entered +ve Number"

Step 5 else

Display "You entered -ve Number"

Step 6 Stop

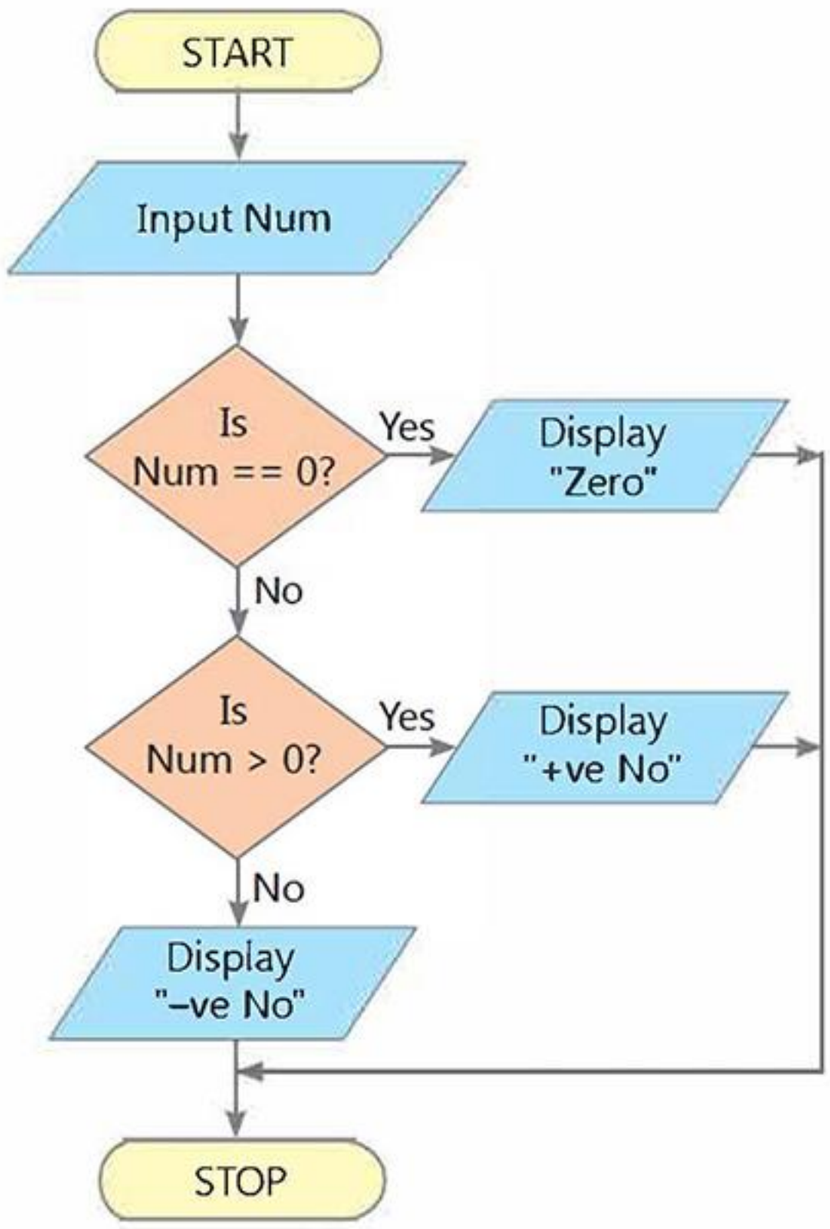
Source Code:

```
Num=int(input("Enter a number:"))
if Num==0 :
    print("You entered zero")
elif Num >0 :
    print("You entered a positive number")
else:
    print("You entered a negative number")
```

Output:

```
Enter a number: -4
You entered a negative number
```

Flowchart



Nested if Statement

Writing one `if` statement within another `if` is called nested `if` statement. Nesting of `if` statement can be upto any level. Indentation plays a very important role in identifying the levels.

Program 9: Write a Python program to input the billing amount and the age of a person. If the billing amount exceeds Rs. 10000 and the person is a senior citizen, a 15% discount will be applied. If the billing amount exceeds Rs. 10000 and the person is not a senior citizen, a 10% discount will be applied. Otherwise, no discount will be given. Calculate the billing amount accordingly.

Algorithm

Step 1 Start

Step 2 Input Amount, Age

Step 3 if Amount is more than 10000 then

Step 4 if Age is greater than or equal to 60 then

Display "Amount after 15% discount is ", Amount-(0.15*Amount)

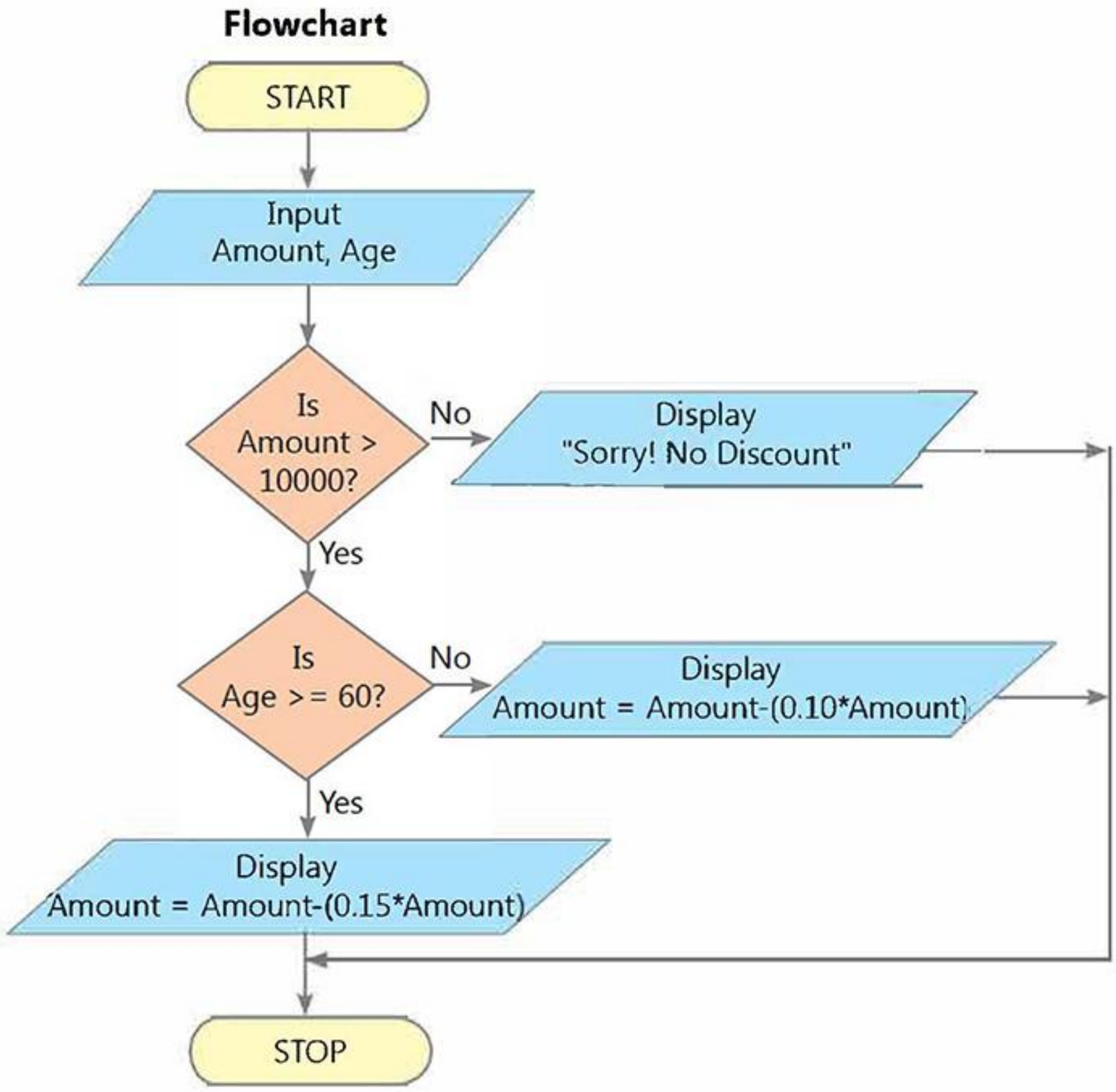
Step 5 else

Display "Amount after 10% discount is ", Amount-(0.10*Amount)

Step 6 else

Display "Sorry! No Discount"

Step 7 Stop



Source Code:

```
Amount=float(input("Enter Billing Amount: Rs. "))
Age=int(input("Enter Age: "))
if Amount > 10000:
    if Age >= 60:
        print("Final billing amount after 15 % discount: Rs. ",Amount-(0.15*Amount))
    else:
        print("Final billing amount after 10 % discount: Rs. ",Amount-(0.10*Amount))
else:
    print("Sorry! No Discount")
```

Output:

```
Enter Billing Amount: Rs. 15000
Enter Age: 61
Final billing amount after 15 % discount: Rs. 12750.0
```

Program 10: To input a number and check whether it is multiple of 5 or not. This check is valid only for positive numbers.

Algorithm

Step 1 Start

Step 2 Input Num

Step 3 if Num is greater than zero then

Step 4 if Num is divisible by 5 then

Display "It is multiple of 5"

Step 5 else

Display "Not multiple of 5"

Step 6 else

Display "Sorry! Invalid Number"

Step 7 Stop

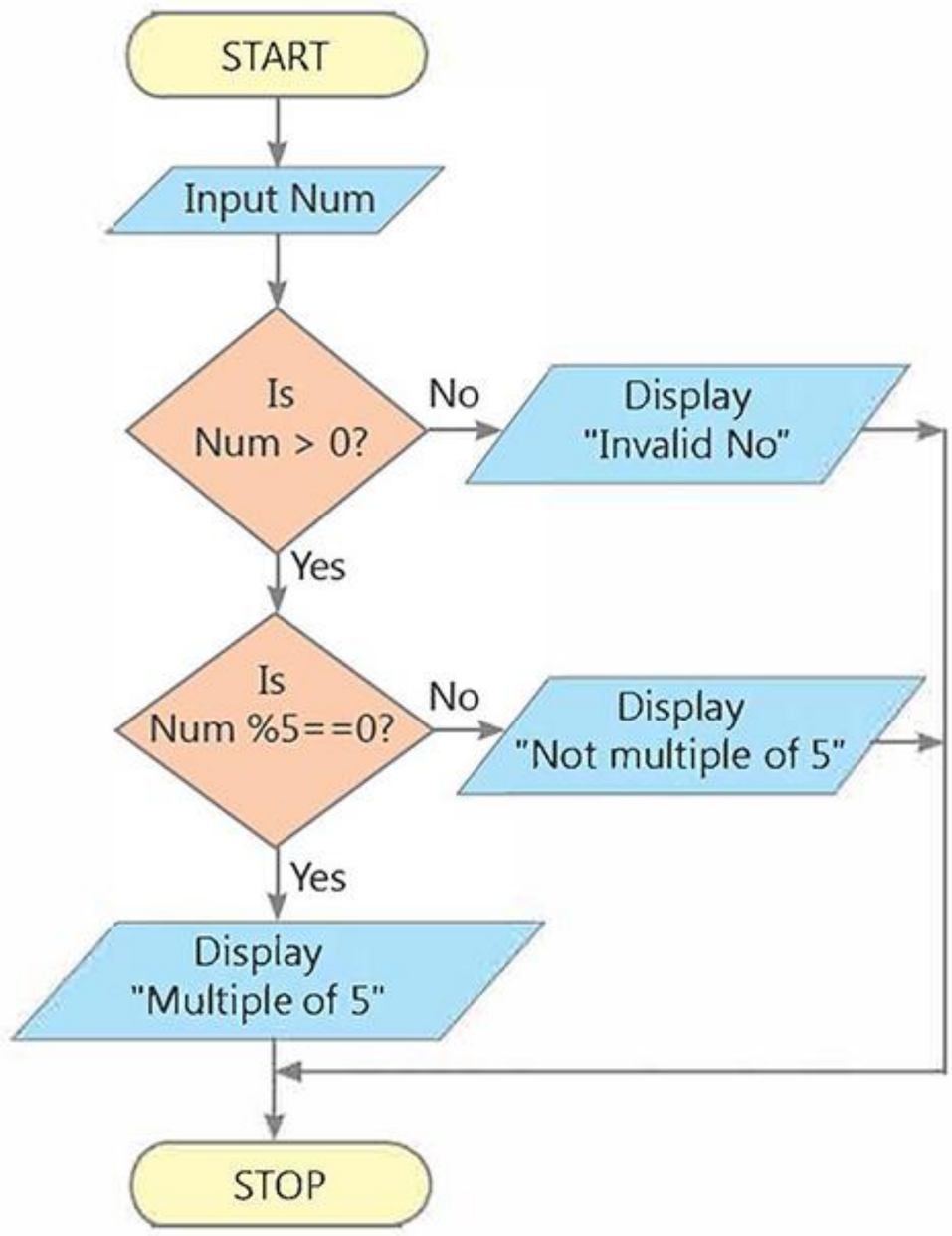
Source Code:

```
Num=int(input("Enter a number: "))
if Num>0:
    if Num%5==0:
        print(Num,"is multiple of 5")
    else:
        print(Num,"is not multiple of 5")
else:
    print("Sorry! Invalid Number")
```

Output:

```
Enter a number: 34
34 is not multiple of 5
```

Flowchart



Brainy Fact

True means non-zero number or non-empty object and False means None or zero number or empty object or none.

Iterative Statements

In Python, the process of repeating a set of instructions based on a condition is called loop or iteration. There are two types of loops in Python—`for` loop and `while` loop. Let us learn about them in detail.

The for Loop

The `for` loop is used to repeat a set of instructions for a fixed number of times. This means the number of iterations are known/definite before we start the execution of the loop. Therefore, the `for` loop is also known as definite loop. Indentation of statements is must to specify the block of statements to be repeated using the `for` loop. There are commonly two different ways of using the `for` loop:

- **Using Sequence:** In this type of `for` loop, a sequence of values is used over which the loop iterate. The syntax to use the `for` loop with a sequence is:

```
for <counter variable> in <sequence>:
    Statements
```

Where,

* `for` is a keyword.

* `counter variable` is any identifier that keeps a count of the loop.
* `sequence` is any values like integer, string, list, etc.
* `Statements` are always indented can be single or a block.

Different examples of `for` loop are:

Commands	Output
`for i in [1,2,3,4]:` `  print(i)`	1 2 3 4
`for words in ["hello", "friends", "how are you?"]:` `  print(words)`	hello friends how are you?
`for alphabets in "hello!":` `  print(alphabets)`	h e l l o !

- **Using the range() Function:** The `range( )` function is an inbuilt function that is used to generate a sequence of values between the specified range. The syntax to use the for loop with a range () function is:

```
for <Var> in range(<Start>, <End>, <Step>):
    Statements
```

Where,

* `for`, `in`, and `range` are keywords.
* `Start`, `End`, and `Step` are parameters of `range()` function and will always be integers.
* `Start` is a starting value of loop, `End` is an ending value (not inclusive) of loop, and `Step` is the number of steps taken to reach the end value.
* If only **two** parameters are used then `Step` value becomes **1** by default.
* If only **one** parameter is used the `Start` becomes **0** and `Step` becomes **1** by default.
* If `Start > End` then `Step` should be a negative integer.
* If `Start < End` then `Step` should be a positive integer.
* If `Start >= End` and `Step` value is not specified, the loop will not execute as this is an invalid condition.

Different examples of for loop with the `range( )` function are:

Commands	Output

`for count in range(1,6,1):`
`  print("hello")`
`print("Program ends")`
	hello
	hello
	hello
	hello
	hello
	Program ends

`for var in range(1,10,2):` `    print(var,end=",")`	1,3,5,7,9
`for count in range(1,10):` `    print(count,end=",")`	1,2,3,4,5,6,7,8,9
`for var in range(10):` `    print(var,end=",")`	0,1,2,3,4,5,6,7,8,9
`for var in range(5,0,-1):` `    print(var,end=",")`	5,4,3,2,1
`for var in range(5,5):` `    print(var,end=",")`	No output
`for var in range(5,3):` `    print(var,end=",")`	No output

`#Program to generate alternate numbers for the given range`
`starts=int(input("enter starting value: "))`
`ends=int(input("enter ending value: "))`
`for var in range(starts, ends+1,2):`
`    print(var,end=",")`
	enter starting value: 5
	enter ending value: 10
	5,7,9,

Brainy Fact

Comparison operators (<, >, <=, >=, !=, ==) and logical operators (and, or) returns True or False.

The while Loop

The `while` loop is used to repeat a set of instructions as long as the condition is true. It means when the number of iterations are not fixed/indefinite before we start with the execution of a loop. Therefore, it is known as an indefinite loop. Indentation of statements is must to specify the block of statements to be repeated using `while` loop.

This loop is also called an entry-controlled loop as it checks for the condition in the beginning. If the condition is 'True' then the body of the loop will be executed. If the condition is 'False' then it will not be allowed to enter within the loop and it stops. The syntax of the `while` loop is:

```
while <condition>
    Statements
```

Where,

- `while` is a keyword.
- `condition` is a criterion to repeat the instructions. The instructions repeat until the condition is 'True'. As soon as the condition is 'False', the control exits from the loop.
- `Statements` are always indented can be single or a block and are repeated till the condition is True.

Brainy Fact

When there is no change of condition in while loop then it becomes infinite loop, For example,

```
i=1
while i<6:
  print(i)
```

In the above code, the value of i will always be **1,** and due to this, the condition will always be True and will keep on executing the statement inside for an infinite number of times.

The different examples of `while` loop are:

Commands	Output

`count=1`
`while count<=5:`
`  print("hello")`
`  count+=1`
`print("Program ends")`
	hello
	hello
	hello
	hello
	hello
	Program ends

`i = 1`
`while i < 6:`
`  print(i)`
`  i += 1`
	1
	2
	3
	4
	5

`"""Input a number and check for even or odd.`
`The whole process should continue till the user wants"""`
`ans = "y"`
`while ans=="y":`
`  num=int(input("enter a number:"))`
`  if num%2==0:`
`  print(num," is Even")`
`  else:`
`  print(num," is Odd")`
`  ans=input("Press 'y' to continue:")`
`print("Program ends here")`
	enter a number: 3
	3 is Odd
	Press 'y' to continue: y
	enter a number: 6
	6 is Even
	Press 'y' to continue: y
	enter a number: 12
	12 is Even
	Press 'y' to continue: n
	Program ends here

Commands	Output

`#display the digits of a number in a reverse order`
`num=int(input("Enter a number "))`
`while num>0:`
`    r=num%10`
`    print(r, end="")`
`    num//=10`
	Enter a number 594
	495

Program 11: To print the sum of first five natural numbers.

Algorithm

Step 1 Start

Step 2 num=1

Step 3 sum=0

Step 4 while num is less than 6

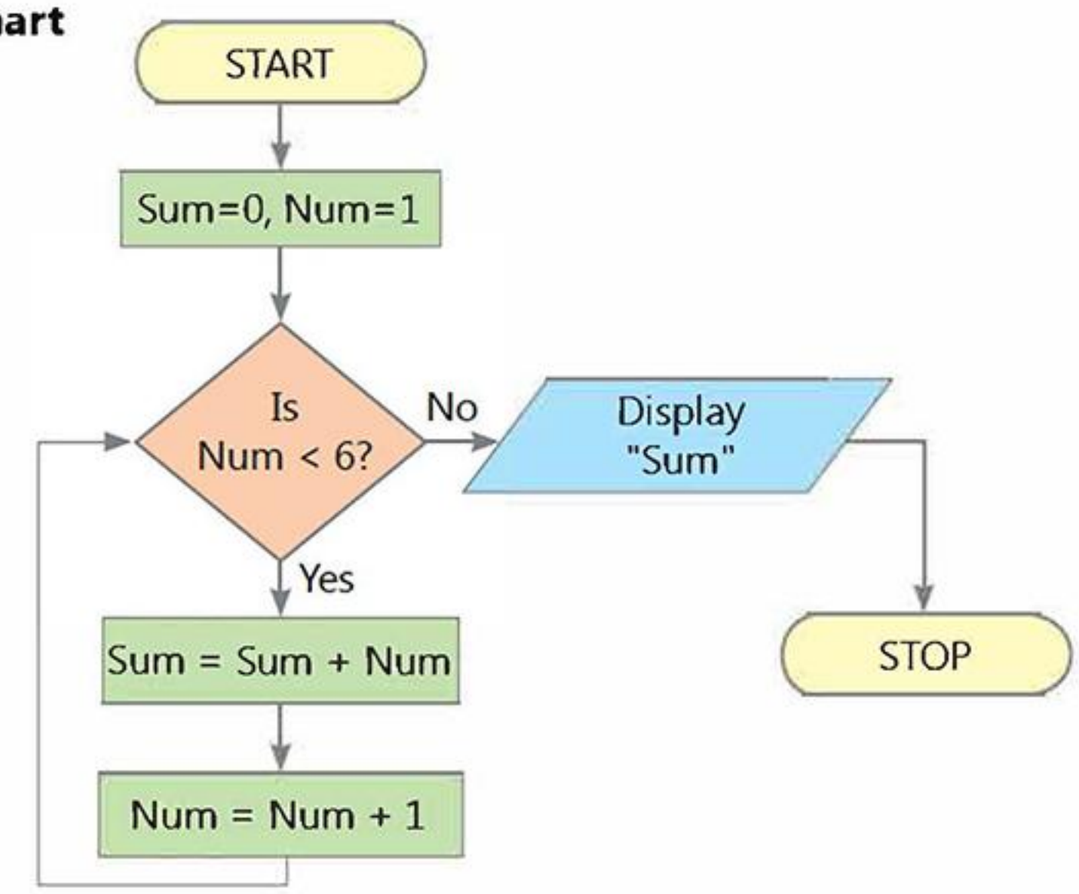
    sum=sum + num

    num = num + 1

Step 5 Display "Sum is ", sum

Step 6 Stop

Flowchart



Source Code:

```
num=1
sum=0
while num<6:
    sum=sum+num
    num=num+1
print("The sum of first five natural numbers is",sum)
```

Output:

```
The sum of first five natural numbers is 15
```

Lists in Python

A list in Python is a collection of items that are ordered and mutable (changeable). It can contain elements of different data types, such as strings, integers, floats, objects, or even other lists. Each value in a list is called an element, and each element is indexed based on its position in the list. The index starts at 0 for the first element, 1 for the second element, and so on. The number of elements in a list determines its length. Lists are defined by enclosing the elements within square brackets [], with each element separated by a comma. For example,

my_list = [1, 2, 3, 'hello', 5.0]

Lists are mutable, meaning that you can change the elements in a list after it has been created. You can add elements to a list, modify existing elements, or remove elements from a list.

Important Features of Lists

Based on the above definition, the list has the following important features:

- It is mutable data type.
- It is an ordered sequence of values.
- Each element is separated by comma and enclosed in square brackets [ ].
- Each value/element is accessed by an index number.
- The values can be added, modified or deleted by the user throughout the program.
- It stores the values of different data types.

Creating a List

A list is created by enclosing the values within square brackets. Each value/element is separated by a comma and stored under a common name. These values can be of different data types. The name follows the rules of naming conventions for identifiers as shown below:

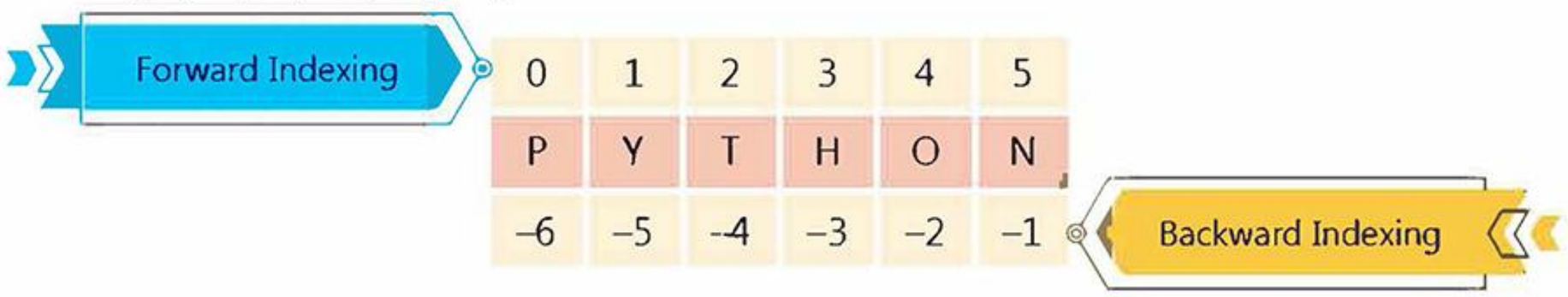
Examples	Commands
Creating an empty list	`list1 = []`
Creating a list with single value	`list2 = [56]`
Creating a list of friends	`friends = ["Saisha", "Advika", "Arshia"]`
Creating a list of marks	`marks=[92, 91, 89, 95, 93]`
Creating a list of students with roll no and percentage (list of mixed values)	`students = [21, "Gunjan", 94.5, 34, "Rohit", 91.3]`
Creating a list within another list	`section = ["A", 25, "English", ["B",34], ["C",37], 56.7]`
Creating a list with repeated values	`L1 = [10] * 5  # L1 will have [10, 10, 10, 10, 10]`
Creating a list from another sequence or string using list( ) function	`alpha = list("hello") #string converted to a list #output will ['h', 'e', 'l', 'l', 'o']`
Values input from the user in a list	`L1 = list(input("enter numbers :"))`

Accessing the Elements of a List

The elements of a list can be accessed by using its index number starts with 0 (zero). There are two different ways of using the index number:

- **Positive/Forward Indexing:** The index number begins with 0 till length-1 and we refer the elements from left to right.
- **Negative/Backward Indexing:** The index number begins with -1 till -length and we refer the elements from right to left. For example,

L1 = ['P', 'Y', 'T', 'H', 'O', 'N']



Each element can be accessed by using:

listname[index number]

Commands	Output
`print(L1[0])`	P
`print(L1[3])`	H
`print(L1[-3])`	H
`print(L1[-1])`	N
`print(L1)  #print complete list`	['P', 'Y', 'T', 'H', 'O', 'N']
`print(L1[0], L1[4])`	P O

Traversing a List

Traversing means visiting each element and processing it as required by a program. We use a loop to traverse a list. There are different ways of visit each element as shown below:

Commands	Output

`L1=['P', 'Y', 'T', 'H', 'O', 'N']`
`for eachvalue in L1:`
`  print(eachvalue, end="!")`
	P!Y!T!H!O!N!

`L1=['P', 'Y', 'T', 'H', 'O', 'N']`
`for indexno in range(len(L1)):`
`  print(L1[indexno],end="!")`
	P!Y!T!H!O!N!

`#The above code is equivalent to:`
`L1=['P', 'Y', 'T', 'H', 'O', 'N']`
`print(L1[0], L1[1], L1[2], L1[3], L1[4], L1[5], sep="!",end="!")`
	P!Y!T!H!O!N!

`#To print the index number of each element in a list`
`L1=['P', 'Y', 'T', 'H', 'O', 'N']`
`for indexno in range(len(L1)):`
`  print(indexno,end="!")`
	0!1!2!3!4!5!

Using + Operator with List

The + operator is used to concatenate the list with another list. Remember that both the operands on either side of the + operator have to be a list only otherwise it gives an error. For example,

Commands	Output

`A = [1, 2, 3]`
`B = [4, 5, 6]`
`C = A + B`
`print(C)`
	[1, 2, 3, 4, 5, 6]

`A = [1, 2, 3]`
`B = [4, 5, 6]`
`B += A`
`print(B)`
	[4, 5, 6, 1, 2, 3]

`A = [1, 2, 3]`
`B = [4, 5, 6]`
`C = [7, 8, 9]`
`D = A + B + C`
`print(D)`
	[1, 2, 3, 4, 5, 6, 7, 8, 9]

`A = [1, 2, 3]`
`B = A + [10, 20]`
`print(B)`
	[1, 2, 3, 10, 20]

`A = [1, 2, 3]`
`B = A + "abc"`
`print(B)`
	TypeError: can only concatenate list (not "str") to list

`l1 = [1, 2, 3]`
`l3 = [7, 8, 9]`
`newlist = l1 + [4, 5, 6] + l3`
`print(newlist)`
	[1, 2, 3, 4, 5, 6, 7, 8, 9]

Using * Operator with List

The * operator is used to replicate a list by a specific number of times. With * operator, one operand has to be a list and the other should only be an integer, otherwise it will give an error. For example,

Commands	Output

`A = [1, 2, 3]`
`B = A * 3`
`print(B)`
	[1, 2, 3, 1, 2, 3, 1, 2, 3]

`X = 5`
`A = [X] * 3`
`print(A)`
	[5, 5, 5]

`name = "Amit"`
`L1= [name] * 4`
`print(L1)`
	['Amit', 'Amit', 'Amit', 'Amit']

`name = "Amit"`
`L1 = [name] *`
`"a"`
	TypeError: can't multiply sequence by non-int of type 'str'

Ai Task

#Experiential Learning

Write the output of the following statements:

1. print(2*"abc") _____
2. print('abc'*2) _____
3. print(2*'abc'*3) _____

Comparing the Lists

The comparison of the lists is done using comparison operators >, <, >=, <=, != and ==. These operators compare the elements in lexicographical order (alphabetically order). For example, if corresponding elements are same, it goes to the next element, and so on until it finds elements that differ. For example,

```
l1 = [1, 2, 3]
l2 = [1, 2, 3]
l3 = [1, 2, [3]]
l4 = [1.0, 2.0, 3,0]
print(l1 == l2)                    #True
print(l1 > l2)                     #False
print(l1 == l3)                    #False
print(l1 == l4)                    #False
print([1, 2, 6] < [1, 2, 5])       #False
print([1, 2, 6] != [1, 2, 5])      #True
print([1, 2, 6] > [1, 2, 5])       #True
```

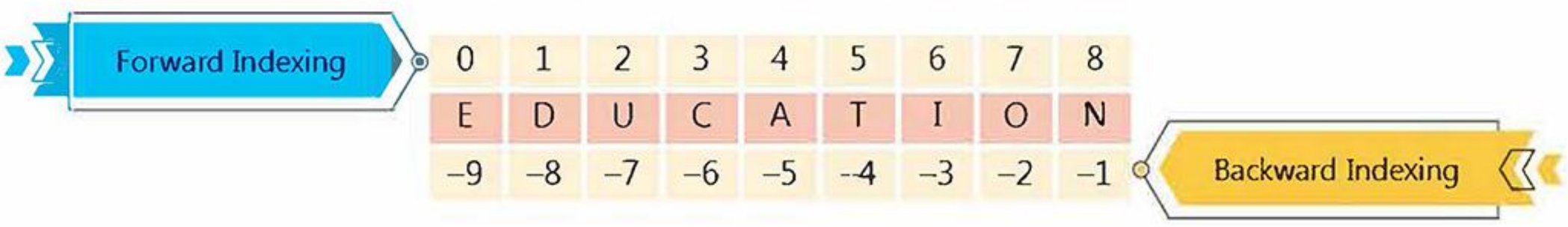
Slicing a List

Slicing a list means accessing a specific portion of a list. This can be done by using a range of index values with start index number, end index number separated by colon. We can use both forward index and backward index to specify the range of slicing in a list. Some important points to consider to do slicing in a list are:

- Elements from beginning to a range - list[: index] or [: -index]
- Elements from specific Index till the end - list[index:]
- Elements within a range - list[start index : end index]
- Elements within range using step value - list[start index : end index : step value]
- Whole list in forward order - list[:] OR list[::] or list[0: len(list)]
- Whole list in reverse order - list[: : -1].

For example,

```
word = ['E', 'D', 'U', 'C', 'A', 'T', 'I', 'O', 'N']
```



Examples	Commands	Output

To display the whole list	`print(word[:])`
	or
	`print(word[::])`
	or
	`print(word[0:])`
	or
	`print(word[-9:])`
		['E', 'D', 'U', 'C', 'A', 'T', 'I', 'O', 'N']

Displays the alternate elements of the given list	`print(word[::2])`	['E', 'U', 'A', 'I', 'N']

To display ['E', 'D', 'U'] from the above list	`print(word[0:3])`
	or
	`print(word[:3])`
	or
	`print(word[-9:-6])`
	or
	`print(word[:-6])`
		['E', 'D', 'U']

To display['C', 'A', 'T'] from the above list	`print(word[3:6])`
	or
	`print(word[-6:-3])`
	or
	`print(word[3:-3])`
		['C', 'A', 'T']

To display ['O', 'I', 'T'] from the above list	`print(word[7:4:-1])`
	or
	`print(word[-2:-5:-1])`
	or
	`print(word[7:-5:-1])`
	or
	`print(word[-2:4:-1])`
		['O', 'I', 'T']

To display the list in reverse order	`print(word[::-1])`	['N', 'O', 'I', 'T', 'A', 'C', 'U', 'D', 'E']

Ai Task

#Experiential Learning

If word = ['E', 'D', 'U', 'C', 'A', 'T', 'I', 'O', 'N']

What will be the output of the following instructions:

- print(word[:1:-2]) _____
- print(word[-1:]) _____
- print(word[:-1]) _____

Adding New Elements to a List

There are three different functions used to add elements in an existing list which are `append( )`, `extend( )` and `insert( )`. Let us learn about them in detail.

The append( ) Function

The `append( )` function appends a single element with the given value(any datatype) at the end of the list. We use this function in a loop for adding multiple elements. With the single `append( )` function, the length of the list will increase by 1. The syntax of the `append( )` function is:

```
list.append(item)
```

where, item can be any value like number, string, list, etc. For example,

Commands	Output

`fruits = ["apple", "banana", "cherries"]`
`fruits.append("melon")`
`print(fruits)`
	['apple', 'banana', 'cherries', 'melon']

`cars = ["Maruti", "Ford"]`
`cars.append("Honda")`
`cars.append("Hyundai")`
`print(cars)`
	['Maruti', 'Ford', 'Honda', 'Hyundai']

`#input names of 5 friends and store in list`
`friends=[]`
`for i in range(5):`
`  nm=input("Enter Friend Name: ")`
`  friends.append(nm)`
`print(friends)`
	Enter Friend Name: Amit
	Enter Friend Name: Sneha
	Enter Friend Name: Swati
	Enter Friend Name: Sudhir
	Enter Friend Name: Shashi
	['Amit', 'Sneha', 'Swati', 'Sudhir', 'Shashi']

`#adding a list at the end of another list`
`pets = ['cat', 'dog', 'rabbit']`
`wild = ['tiger', 'lion']`
`pets.append(wild)`
`print(pets)`
	['cat', 'dog', 'rabbit', ['tiger', 'lion']]

The extend( ) Function

The `extend()` function is used to append multiple values at a time in a list. The syntax of the extend() function is:

```
list.extend(iterable value)
```

where iterable value can be a list. For example,

Commands	Output

`n=[1,2,3,4]`
`m=[5]`
`n.extend(m)`
`print(n)`
	[1, 2, 3, 4, 5]

`pets = ['cat', 'dog', 'rabbit']`
`wild=['tiger', 'lion']`
`pets.extend(wild)`
`print(pets)`
	['cat', 'dog', 'rabbit', 'tiger', 'lion']

The insert( ) Function

The `insert()` function is used to add a single value at a specific position in an existing list. The length of the list will increase by one. The syntax of the `insert()` function is:

```
list.insert(index, value)
```

For example,

Commands	Output

`L = [10, 20, 30]`
`L.insert(1, 40)`
`print(L)`
	[10, 40, 20, 30]

`L = [10, 20, 30]`
`L.insert(0, "abc")`
`print(L)`
	['abc', 10, 20, 30]

`L = [10, 20, 30]`
`a = "xyz"`
`L.insert(2, a)`
`print(L)`
	[10, 20, 'xyz', 30]

`L = [10, 20, 30]`
`L.insert(1, ["a", "b"])`
`print(L)`
	[10, ['a', 'b'], 20, 30]

Modifying Existing Values in a List

List is mutable so data can be easily modified by overwriting a new value to an existing value in a given list by using an assignment operator (=). Syntax to modify existing values in a list is:

```
list[index] = newvalue
```

For example,

Commands	Output

`L1=[10,20,40,50]`
`L1[3]=100`
`print(L1)`
	[10, 20, 40, 100]

`L1=[10,20,40,50]`
`L1[1:3]=["abc","xyz"]`
`print(L1)`
	[10, 'abc', 'xyz', 100]

Removing Elements from a List

There are two different functions used to remove elements in an existing list `remove()` and `pop()`. Let us learn about these functions in detail.

The remove( ) Function

The `remove()` function removes the first occurrence of the element with the specified value. It means only one value can be removed at a time even if there are duplicate values in the list. If you wish to remove multiple values then this function can be used within a loop where it repeats itself a specific number of times. The syntax of the `remove()` function is:

```
list.remove(<single value>)
```

For example,

Commands	Output

`marks = [23, 34, 23, 45, 56, 78, 56]`
`marks.remove(23)`
`print(marks)`
	[34, 23, 45, 56, 78, 56]

`marks = [23, 34, 23, 45, 56, 78, 56]`
`marks.remove(56)`
`print(marks)`
	[23, 34, 23, 45, 78, 56]

`marks = [23, 34, 23, 45, 56, 78, 56]`
`marks.remove(72)`
`print(marks)`
	ValueError: list.remove(x): x not in list

The pop( ) Function

The `pop()` function removes an element from the list based on the index number specified in the function and returns the deleted value. In case no index number is given then by default it removes the last element from the list. If we try to remove an index number which does not exist then it gives an IndexError.

For example,

Commands	Output

`vowels=['a', 'e', 'i', 'o', 'u']`
`val=vowels.pop(2)`
`print(val)`
	i

`vowels=['a', 'e', 'i', 'o', 'u']`
`val=vowels.pop()`
`print(val)`
	u

`vowels=['a', 'e', 'i', 'o', 'u']`
`val=vowels.pop(6)`
`print(val)`
	IndexError: pop index out of range

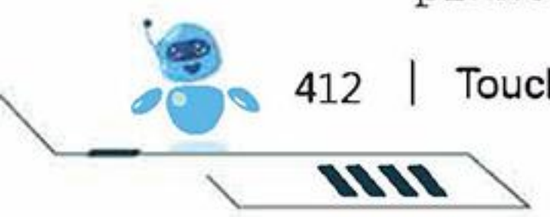
`lst=[]` `lst.pop()`	IndexError: pop from empty list

Some other Functions Used with List

There are some other functions also available to use with the list which are as follows:

- **len():** This function returns the length of a list. For example,

```
marks = [10, 34, 42, 21, 45]
      print(len(marks))
```



Output: 5

- **clear():** This function removes all the elements of the list in one go. It empties the list but the empty list still exists in Python which can be used later to fill the values. For example,

```
city=["Delhi", "Mumbai", "Kolkata", "Chennai"]
city.clear()
print(city)
```

Output: [ ]

- **reverse():** This function reverses the content of the list "in place". For example,

```
alpha = ['a', 'b', 'c', 'd', 'e']
alpha.reverse()
print(alpha)
```

Output: ['e', 'd', 'c', 'b', 'a']

- **sort():** This function sorts the list in ascending or descending order. This is done "in the list itself" and works for the list with values of the same data types. For example,

```
city=["Delhi", "Mumbai", "Kolkata", "Chennai"]
city.sort() #sorts the list by default in ascending order
print(city)
```

Output: ["Chennai", "Delhi", "Kolkata", "Mumbai"]

```
city.sort(reverse=True)#sorts the list descending order
```

Output: ["Mumbai", "Kolkata", "Delhi", "Chennai"]

- **index():** It returns the index number of the value given in the function. For example,

```
city=["Delhi", "Mumbai", "Kolkata", "Chennai"]
print (city.index("Kolkata"))
```

Output: 2

```
print (city.index("Pune"))
```

Output: `ValueError: 'Pune' is not in list`

It returns ValueError exception if the value is not found in the list.

- **count():** This function counts the number of occurrences of the specified value in the given list. If the value doesn't exist, then the function returns 0. For example,

```
marks = [56, 67, 45, 78, 56, 78, 12]
marks.count(78)
```

Output: 2

```
marks.count(10) # 10 does not exist in the list.
```

Output: 0

At a Glance

- A program is written in any programming language which the computer can understand and execute.
- Control structures are a set of instructions that control the flow of instructions in a program.
- An algorithm is a step-by-step approach to identify and solve a problem in a finite time.
- A flowchart is a graphical representation of an algorithm.
- CodeCombat is a free coding educational game that teaches you to learn JavaScript or Python coding in a fun way.
- Python is a general-purpose, object oriented, easy to learn and high-level programming language.
- Instructions written in a source code that are executed by a Python interpreter are called statements.
- Keywords in Python are predefined and reserved words with special meanings and purposes.
- Tokens are the smallest meaningful unit of a program.
- Identifiers are the user defined names of variables, list, dictionary, tuples, classes, etc.
- Variable is a name given to a memory location to hold a specific value.
- Data types specify the kind of a value a variable can store. It helps us to identify the kind of operation that can be performed on that specific data type.
- Operators are special symbols used to perform mathematical, logical and relational operations on variables and values.
- Comments are used to increase the readability of the code.
- The print() function is used to print an output on the screen.
- The order of execution of these instructions controls the flow of a program.
- A step-by-step process of execution of code is called sequential flow of control.
- Selection flow of control is achieved through conditional statements.
- The process of repeating a set of instructions based on a condition is called loop.
- The range( ) function is an inbuilt function that is used to generate a sequence of values between the specified range.
- List is a collection of heterogeneous data arranged in a sequence.
- The elements of a list can be accessed by using its index number starts with 0 (zero).
- The + operator is used to concatenate the list with another list.
- The * operator is used to replicate a list specific number of times.
- The comparison of the lists is done using comparison operators >, <, >=, <=, != and ==.
- The append( ) Function appends a single element with the given value(any datatype) at the end of the list.
- The extend() Function is used to append multiple values at a time in a list.
- The insert( ) function is used to add a single value at a specific position in an existing list.
- The remove( ) function removes the first occurrence of the element with the specified value.
- The pop( ) function removes an element from the list based on the index number specified in the function and returns the deleted value.

Exercise

Solved Questions

SECTION A (Objective Type Questions)

AI Quiz

A. Tick (✓) the correct option.

1. Which of the following symbols is used in flowcharts to take input from the user?
   a. Diamond ○ b. Rectangle ○
   c. Oval ○ d. Parallelogram ○

2. Coding and implementation is the ..... step in problem-solving.
   a. First ○ b. Last ○
   c. Third ○ d. Second ○

3. Which of the following symbols is used to display the decision-making statements in a flowchart?
   a. Rectangle ○ b. Line ○
   c. Diamond ○ d. Oval ○

4. Which of the following is the step-by-step approach in simple English-like statements?
   a. Algorithm ○ b. Selection ○
   c. Flowchart ○ d. Sequence ○

5. Which of the following is/are powerful tools for learning programming?
   a. Flowchart ○ b. Algorithm ○
   c. Both a and b ○ d. None of these ○

6. Which of the following is the valid name for (an) identifier(s) in Python?
   a. Test#4 ○ b. Rollno ○
   c. 9thClass ○ d. else ○

7. Which of the following is a valid logical operator?
   a. and ○ b. != ○
   c. + ○ d. >= ○

8. ZeroDivisionError error is a .....
   a. Syntax Error ○ b. Logical Error ○
   c. Runtime Error ○ d. Not an Error ○

9. Which of the following is a sequence of UNICODE characters?
   a. Boolean ○ b. Numbers ○
   c. String ○ d. Float ○

10. Which of the following is a data type that has two built-in values True or False?
    a. String ○ b. Boolean ○
    c. Integer ○ d. Float ○

11. Which of the following conditional statements is used to test multiple conditions?

a. if ◯ b. if...elif...else ◯

c. if...else ◯ d. All of these ◯

12. What will be the output of the following code?

```
if(True):
    print("Hello")
else:
    print("Hi")
```

a. Hello ◯ b. Hello Hi ◯

c. Hi ◯ d. Nothing will print ◯

13. If L1 = ['O', 'R', 'A', 'N', 'G', 'E'], then what will be the output of the following statement?

```
print(L1)
```

a. 'ORANGE' ◯ b. ['O', 'R', 'A', 'N', 'G', 'E'] ◯

c. 'O', 'R', 'A', 'N', 'G', 'E' ◯ d. None of these ◯

14. Consider the following code:

```
A = ["Orange"]
B = ["Education"]
C = A + B
print(C)
```

Which of the following will be the output of the preceding code?

a. ['Orange', 'Education'] ◯ b. ['Orange Education'] ◯

c. Orange Education ◯ d. Orange + Education ◯

15. If L1 = ['O', 'R', 'A', 'N', 'G', 'E'], then which of the following will be the output of the given statement?

```
print(L1[::-1])
```

a. Prints the list as it is ◯ b. Prints the list in reverse order ◯

c. Prints the last element of the list ◯ d. Prints the first element of the list ◯

B. Fill in the blanks.

1. A ..... is written in any programming language.
2. In ..... flow statements are placed one after the other.
3. In the branching statement, the condition evaluates to either ..... or .....
4. Algorithm is ..... approach to identify and solve a problem.
5. Python is an ..... language.
6. Remainder operator and floor division are ..... operators.
7. ..... and ..... are two different ways of writing comments.
8. The ..... function is used to find the data type of the objects.
9. A ..... is a set of instructions given to a computer to do a specific task.
10. Conditional programming allows a block of statement to be executed based on a .....
11. There are ..... ways to repeat a set of instructions in Python.

12. While loop is also called ..... loop.
13. List is a collection of ..... data arranged in a sequence.
14. List is a ..... data type in Python.
15. The index number begins with 0 till length-1 in .....

C. State whether these statements are true or false.

1. Understanding the problem is the last step in computer problem-solving. .....
2. The append( ) function appends a single element with the given value(any datatype) at the end of the list. .....
3. Flowcharts are difficult to maintain for complex programs. .....
4. A block is identified by using an indentation (minimum of 1 space). .....
5. Algorithms are just a waste of time before writing a code. .....
6. The rectangle symbol is used to start and end a flowchart. .....
7. Indentation is not important in conditional programming. .....
8. The * operator is used to replicate a list by a specific number of times. .....
9. For loop is used to give conditions and executes only once. .....
10. If the condition is True then the block of statement written for True will be executed. .....
11. The count( ) returns the index number of the value given in the function. .....
12. Slicing a list means accessing a specific portion of a list. .....
13. The index() function return TypeError exception if the value is not found in the list. .....
14. We cannot create an empty list. .....
15. A list can be created within another list. .....

D. Find the errors in the given code and write the correct code:

1.
```
a = input("enter a number)
```
Ans.
```
a = input("enter a number")
```
2.
```
b + c = a
```
Ans.
```
a = b + c
```
3.
```
print("hello"+ Friends")
```
Ans.
```
print("hello" + "Friends")
```
4.
```
marks==total/2
```
Ans.
```
marks=total/2
```
5.
```
a=input(int("enter marks"))
```
Ans.
```
a=int(input("enter marks"))
```
6.
```
num#1 = 100
if (num == 100)
    print (Number is: num
print ("Thanks!")
```
Ans. Correct code is:
```
num = 100
```

```
if (num == 100):
    print ("Number is:", num)
print ("Thanks!")
```

7.
```
5=a
b=int(input(Enter value for b))
if a<b
    print('a is bigger")
Else:
  print("b is bigger"
```

Ans. Correct code is:

```
a=5
b=int(input("Enter value for b: "))
if a>b:
    print("a is bigger")
else:
    print("b is bigger")
```

E. Solve the given expressions based on operator precedence:

1. 2 ** 5 – 35 // 3

Ans. 32 – 11

21

2. not 15 < 2 or 2 ** 3 > 12/3

Ans. not False or 8 > 12 / 3

not False or True

True or True

True

3. 6 * 5 – 14 // 7 + 2 ** 3

Ans. 30 – 2 + 8

36

4. 50 // 9 - 2 * 5

Ans. 5 - 2 * 5

5 - 10

-5

5. 3 ** 3 + 10 – 22 // 2

Ans. 27 + 10 – 11

37 – 11

26

SECTION B (Subjective Type Questions)

A. Short answer type questions:

1. What is a program?

Ans. The step-by-step instruction written in any programming language to do a specific task is known as a Program. A program is written in any programming language which the computer can understand and execute.

2. What is CodeCombat?

Ans. CodeCombat is a free coding educational game that teaches you to learn JavaScript or Python coding in a fun way. It is available for all age groups to suit the needs of all levels of coding and computer science learners.

3. What is the use of an arrow in flowchart?

Ans. It represents the direction of flow of instructions in a flowchart.

4. Name the steps involved in computer problem-solving.

Ans. Computer problem-solving involves several steps, which are as follows:

- Understanding the problem
- Analysing the problem
- Developing the solution
- Coding and implementation

5. How did Python get its name?

Ans. Guido van Rossum designed Python and released in 1991. He wanted to give a unique name to it. So, he named it after the famous BBC comedy TV show "Monty Python's Flying Circus".

6. Why is Python considered as a high-level language?

Ans. Python is a high-level and general-purpose programming language which simplifies the process of developing a program. The code written in Python is more close to human language and away from machine language.

7. Name different modes of working in Python.

Ans. The two different modes of working in Python are:

- Interactive Mode
- Script Mode

8. What are tokens in Python? Name a few of them.

Ans. Tokens are the smallest meaningful unit of a program. Tokens supported by Python are Keywords, Identifiers, Literals, Operators and Punctuators.

9. What is the use of 'if' statement in Python?

Ans. In 'if' statement, a statement or block of statement will be executed only when the condition is True. If the condition is False then nothing happens.

10. How is a block of statements identified in Selection or Iteration?

Ans. A block is identified by using an indentation (minimum 1 space). Ensure that all statements in one block are indented at the same level.

11. What is iteration?

Ans. Iteration refers to the process of repeating a set of instructions based on a condition.

12 What is the use of the + operator with lists?

Ans. The + operator is used to concatenate a list with another list.

13. What do you mean by traversing a list?

Ans. Traversing a list means to visit each element and process it as required by a program.

14. What is the use of the pop( ) function?

Ans. The pop( ) function removes an element from the list based on the index number specified in the function and returns the deleted value.

B. Long answer type questions:

1. What is sequential flow? Explain with an example.

Ans. In sequential flow, the statements are placed one after the other and the flow of execution occurs starting from line 1, line 2 and so on with a top to down approach. It is the default flow followed in any programming language. For example, the steps for calculating the percentage of any student

1. Input marks of English, Hindi, and Math
2. Total the marks
3. Calculate the percentage
4. Display the percentage

2. Explain the important symbols of flowchart.

Ans.

Symbol	Description
Oval	Used to start and end a flowchart.
Parallelogram	Used for input and output operation.
Rectangle	Used for assignment, mathematical operations, processing
Diamond	Used for decision-making in case of branching or looping.
Arrow	Used to show the direction of the flow of information.

3. Explain the use of print( ) function with all its parameters.

Ans. The print() function is used to print an output on the screen. It converts the expressions into a string before writing to the screen. Syntax to use the print( ) function is:

```
print(object(s), sep = separator, end = end)
```

Where,

- **object** can be one or more separated by comma and it can be a variable, literal, expression. An object will be converted to string before printed.
- **sep** is used as a separator if there are more than one objects.
- **end** specifies what to print at the end. Default is newline '\n'.

4. Give two different ways of writing statements in Python.

Ans.
- **Simple statements:** By default, the end of a statement is done by pressing an **Enter** key. Each statement is written on a new line.

  a=5 is a simple statement where variable-a is created with value 5.

  c=a + b

- **Multiline Statements:** We can make a statement that extends over multiple lines by using line **continuation character (\)** as shown below:

  a = 4 + 5 +\

  6 + 7 +\

  8 + 9

- The main advantage of using multiline is when we need to do long calculations and cannot fit these statements into one line.

5. Explain if...else statement with example.

Ans. When the condition is 'True' then the statements indented just below the if statement will be executed and if the condition is 'False' then the statements indented just below the else statement will be executed. Syntax is:

```
if (condition):
```

```
        Statements for True
    else:
        Statements for False
```

Example:

```
age=int(input("Enter your age: "))
if (age>=18):
    print("Eligible for driving")
else:
    print("Not eligible")
```

6. Explain "for" loop with an example.

Ans. It is used to repeat a set of instructions for a fixed number of times. This means when the number of iterations are known/definite before we start the execution of the loop. It is therefore also known as definite loop. Indentation of statements is must to specify the block of statements to be repeated using for loop.

There are two ways to use for loop:

- Using sequence
- Using range() function

Example:

```
for i in range(10, 0, -1):
    print(i)
```

7. Explain while loop with example.

Ans. It is used to repeat a set of instructions as long as the condition is true. It means when the number of iterations are not fixed/indefinite before we start with the execution of a loop. Therefore, it is known as an indefinite loop. Indentation of statements is must to specify the block of statements to be repeated using while loop.

This loop is also called an entry-controlled loop as it checks for the condition in the beginning only. If the condition is 'True' then the body of the loop will be executed. If the condition is 'False' then it will not be allowed to enter within the loop and it stops. The syntax of the while loop is:

```
while <condition>:
    statements
```

Where,

`while` is a keyword.

`condition` is a criterion to repeat the instructions. The instructions repeat till the condition is 'True'. As soon as the condition is 'False', the control exits from the loop.

`Statements` are always indented can be single or a block and are repeated till the condition is 'True'.

For example,

```
i = 1
while i < 6:
    print(i)
    i += 1
```

8. What is negative indexing? Explain with an example.

Ans. In negative indexing, the index number begins with -1 till -length and we refer the elements from right to left.

For example, book=['C', 'O', 'M', 'P', 'U', 'T', 'E', 'R']

So, each letter gets an element number starting from -1

print(book[2:4]) will give an output ['M', 'P']

print(book[-7:-3]) will give an output ['O', 'M', 'P', 'U']

9. How can we modify elements in a list?

Ans. List is mutable so data can be easily modified by overwriting a new value to an existing value in a given list by using an assignment operator (=).

Syntax:

```
list[index] = newvalue
```

For example,

```
l1 = [10, 20, 40, 50]
l1[3] = 100
print(l1)
```

10. Find the output of the following codes:

a. `l1=[10,20,40,50]`
`l1[1:3]=["abc","xyz"]`
`print(l1)`
	[10, 'abc', 'xyz', 50]

b. `names=["yash","amit","rhea","mayank"]`
`names.sort()`
`print(names)`
	['amit', 'mayank', 'rhea', 'yash']

c. `A=[10,20,34,56,"abc","xyz",89.5,67]`
`A.remove("abc")`
`A.pop()`
`print(A)`
	[10, 20, 34, 56, 'xyz', 89.5]

d. `l1=[1,2,3,4,5,6]` `print(l1[1:]+l1[:1])`	[2, 3, 4, 5, 6, 1]

e. `x=2`
`for i in range(1,5):`
`  l=[i]*x`
`  print(l,end='')`
	[1, 1][2, 2][3, 3][4, 4]

11. Write an algorithm to check if a number is an Armstrong number.

Ans. Find out whether the number is Armstrong or not.

Step 1 Start

Step 2 input num

Step 3 sum=0, n=num

Step 4 If n>0 goto Step 4.1 else Goto Step 7

Step 4.1 d=n%10

Step 4.2 sum=sum+(d*d*d)

Step 4.3 n=n//10

Step 5 if sum==num then

Print "Armstrong Number"

Step 6 else

Print "Not Armstrong Number"

Step 7 Stop

12. Write a menu-driven program to find the volume of a sphere and a cylinder.

Ans.
```
print("Select the vessel whose volume you want to find: \n1. Sphere\n2. Cylinder")
a = int(input())
pi = 3.14
if(a == 1):
    print("Enter the radius of the sphere: ")
    r = int(input())
    volume = ((4/3)*pi*r*r*r)
    print("Volume of the sphere is: ",volume)
elif(a==2):
    print("Enter the radius of the cylinder: ")
    r = int(input())
    print("Enter the height of the cylinder: ")
    h = int(input())
    volume = pi*r*r*h
    print("Volume of the cylinder is: ",volume)
else:
    print("Invalid choice")
```

C. Write a program for the given instructions.

1. Input three numbers and print the largest of three numbers using the if statement.

Ans.
```
a=int(input("enter first number: "))
b=int(input("enter second number: "))
c=int(input("enter third number: "))
larg=a
if b>larg:
    larg=b
if c>larg:
    larg=c
print("largest of all is ",larg)
```

2. Input a number and print the table of the number.

Ans.
```
num=int(input("enter a number "))
for i in range(1,11):
    print(num,"×",i,"=",num*i)
```

3. Input a character and check whether it is an uppercase, lowercase character, or digit, or any other character.

Ans.
```
ch = input("Enter a character:")
if ch>='A' and ch<='Z':
    print("Uppercase")
elif ch>='a' and ch<='z':
    print("Lowercase")
```

```
elif ch>='0' and ch<='9':
    print("Number")
else:
    print("Other Character")
```

4. Print the sum of even or odd numbers of first n natural numbers.

Ans.
```
n=int(input("Enter range of natural numbers :"))
sumeven=sumodd=0
i=0
while i<=n:
    if i%2==0:
        sumeven+=i
    else:
        sumodd+=i
    i+=1
print("Sum of even :",sumeven)
print("Sum of odd :",sumodd)
```

5. Input a number and print the next five consecutive numbers.

Ans.
```
n=int(input("Enter a number :"))
for i in range(n+1,n+6):
    print(i)
```

6. Print each element of a list along with its index number (both forward and backward).

Ans.
```
L1= ['P', 'Y', 'T', 'H', 'O', 'N']
length=len(L1)
for e in range(length):
    print("Forward indexing:",e, "Backward Indexing:",(e-length), "Element Value is
    ",L1[e])
```

7. Print the sum of even numbers in a list.

Ans.
```
l=[1,12,6,3,8,7,13]
sum=0
for i in range(len(l)):
    if l[i]%2==0:
        sum+=l[i]
print(sum)
```

8. Swap the adjacent elements in the list. Print the list after swapping is done.

Ans.
```
#swapping the adjacent value
L1=[1,2,3,4,5]
print("list before change",L1)
l=len(L1)
if l%2==0:
    for i in range(0,l,2):
        L1[i], L1[i+1]=L1[i+1],L1[i]
else:
    for i in range(0,l-1,2):
        L1[i],L1[i+1]=L1[i+1],L1[i]
print("list after change",L1)
```

9. To store only integers in a new list by copying from the given list.

Ans.
```
L=[12,"abc",45.6,True,34,45]
L2=[]
for i in L:
    if type(i)==int:
        L2.append(i)
print(L2)
```

10. Search a specific value and display its number of occurrences in a list.

Ans.
```
L=[10,23,45,10,12,34,10,56]
s=int(input("Enter value you want to search: "))
count=0
for i in L:
    if i==s:
        count+=1
print(s," occurs ",count," times")
```

Unsolved Questions

SECTION A (Objective Type Questions)

AiQuiz

A. Tick (✓) the correct option.

1. Which of the following is not the conditional statement in Python?
   a. if Statement ○ b. if...elif...else Statement ○
   c. if...else Statement ○ d. for Statement ○
2. Which of the following is a looping statement in Python?
   a. for statement ○ b. while statement ○
   c. Both a and b ○ d. None of these ○
3. Which of the following statements allows to repeat a task for a fixed number of times?
   a. for statement ○ b. if...else statement ○
   c. while statement ○ d. continue statement ○
4. Which of the following can be a part of a list?
   a. String values ○ b. Integer values ○
   c. List ○ d. All of these ○
5. If a list named L1 contains 4 elements, then which of the following can be used to access the last element of the L1 list?
   a. L1[4-1] ○ b. L1[4] ○
   c. L1[-1] ○ d. Both a and c ○

B. Fill in the blanks.

1. An ..... uses simple English-like statements.
2. If A = 10 then the statement: if A > 5: print(A); will display ..... as an output.
3. ..... uses symbols for writing a set of instructions.

4. ..... is used for preparing documentation of an application.
5. ..... designed Python and released it in 1991 can be freely downloaded from the website .....
6. Examples of assignment operators are ..... and .....
7. ..... is a character encoding standard that uses numeric codes to represent characters in upper and lower cases, numbers, and punctuation symbols.
8. ..... is a special literal.
9. In ..... programming, the program instructions are executed one after the other in a sequence.
10. The block of statements is executed based on a ..... using if statement.
11. ..... keyword is optional with the if statement.
12. ..... means visiting each element and processing it as required by a program.
13. ..... indexing begins with -1.
14. ..... refers to the rules for writing code in the Python language.
15. ..... function will delete all the elements in a list.

C. State whether these statements are true or false.

1. Modification of the program through a flowchart is sometimes time-consuming. .....
2. It is easy to represent branching and looping in an algorithm. .....
3. CodeCombat is a free coding educational game available on the internet. .....
4. Integers are used for mathematical calculations. .....
5. Python is easy to learn as a high-level programming language. .....
6. It is optional to specify colon(:) after writing a condition with the if statement. .....
7. Step value can be -ve or +ve in for loop. .....
8. Each value/element is separated by a comma in a list. .....
9. There are different ways of visiting each element of a list. .....
10. The append() can be used to append any value at any location in a list. .....

D. Find the errors in the given code and rewrite the correct code:

1.
```
x,y=10
a=input("enter number')
print("number entered is,a)
a+5,b=10,20
a=a+10
    print(a)
```

2.
```
y=int(input("Enter Y:")
if y<10
    print('smaller")
else:
    print(y)
```

3.
```
M=int(input("Enter M'))
while M<10
 if M=5:
   print("Middle Value")
 else:
   print(M)
 M=+1
```

4.
```
str="book"
i=0
While i=<1:
    print(str, sepa="%")
    1+=i
```

E. Rewrite the following logic:

1. Using while loop

```
for C in range(1,5,2):
    print (C)
print("Python")
```

2. Using for loop

```
sum=0
i=20
while i>10:
    sum+=i
        i-=2
print(sum)
```

F. Find the output of the given code:

1.
```
A=10
for i in range(2, A, 2):
    print(A,i,sep='2',end='*')
```

2.
```
I = 10; J = 50
if (I > 10 and J < 100):
    print(I, J)
else:
    print(J)
```

3.
```
for i in range(5):
    if i%2==0:
        print(i, end="*")
```

SECTION B (Subjective Type Questions)

A. Short answer type questions:

1. Name the two coding programs available in CodeCombat.
2. Why are flowcharts more preferred than algorithms?
3. Can we write more than one algorithm for the same problem? Explain.
4. What is the meaning of selection flow in control structures?
5. How can we create a multi-line string in Python?
6. What is the use of the print( ) function? Give a few examples to support your answer.
7. What are variables? Why are they important in any programming language?
8. How is floor division different from normal division?
9. What is the meaning of sequential programming?
10. What is nested if statement?
11. Why is it necessary to give step value in while loop?
12. Why while loop called an entry-controlled loop?
13. What is the use of sort( ) function of a list?
14. What are the key features of Python? Mention various applications along with it. [CBSE Handbook]
15. What is the difference between pop( ) and remove( ) functions?
16. What will be the output of the following statement?

```
print([1, 2, 6] < [1, 2, 5])
```

B. Long answer type questions:

1. Give three differences between an algorithm and a flowchart.
2. Explain three symbols used in flowcharts.
3. Explain the steps involved in computer problem-solving.
4. Explain with an example the three control structures.
5. Explain mathematical operators with examples.

6. What are comments in Python? List down the various types of comments. [CBSE Handbook]
7. Explain the three different numeric data types available in Python.
8. Explain different types of errors in Python.
9. What is type conversion? Explain the types of type conversion with the help of an example. [CBSE Handbook]
10. Differentiate between the for loop and the while loop.
11. List the important rules to remember when using the range() function in the for loop.
12. Name different ways of deleting an element in a list.
13. What is the use of the * operator in a list?
14. Explain two different ways of indexing in a list.

C. Write Python code for the given instructions.

1. Input three angles and check whether they form a triangle or not.
2. Input time in seconds and change it into minutes.
3. Find the result of 22/7 * 5 * 5 i.e. the area of a circle having a radius of 5. [CBSE Handbook]
4. Input length and breadth and display whether it is a square or not.
5. Input a number between 1 and 7 and display the weekday based on the number entered.
6. Take a Boolean value "False" and a float number "15.6" and perform the AND operation on both. [CBSE Handbook]
7. Input Salary and Years of Service. If the number of years is more than 5 then give an extra bonus of 15%. Display the net salary after adding the bonus.
8. Take a string "Zero" and a Boolean value "True" and try adding both by using the Bool () function. [CBSE Handbook]
9. Input the billing amount of shopping done. If the amount is more than 5000 then give a discount of 10%. Display the net billing amount after the discount.
10. Take a Boolean value and add a string to it. [CBSE Handbook]
11. Take a string "Morning "and the float value "90.4" and try and add both of them by using the float () function. [CBSE Handbook]

#Computational Thinking

Ai Lab

1. Write an algorithm for calculating the Net salary of a person (Net Salary=Basic + Allowances – Deductions). Take the Basic, Allowances and Deductions as input.
2. Write an algorithm to print the larger of the two marks taken an input. Also, draw a flowchart.
3 Write a Python program to:
   a. Convert Celsius to Fahrenheit using the formula: (Celsius * 1.8) + 32
   b. Input five names from the user and print them in the same line with a single space.
   c. Swap the values of two variables using the third variable.
   d. Convert kilometre unit to metre.
   e. Calculate the area of a square.
   f. Interchange the values of the adjacent elements of the list. Print the updated list.
   g. Input five names of cities in a list. Accept a name and check whether it exists in a list or not. Display an appropriate message.

h. Input five subject's marks in a list and print the percentage of all.

i. Create a list with heterogeneous values and print the values which are only integer.

j. Create a list of five subject's marks and print the marks >50.

4. Find the output of the following programs:

a. A list is declared as

```
marks = [20,15,45,25,30]
```

What will be the output of

```
print(3*marks[2] - 4*marks[4])
```

b.
```
word=['P','R','O','G','R','A','M']
print(word[-4:])
print(word[::-2])
```

c.
```
word=['P','R','O','G','R','A','M']
print(word.count('R'))
print(word.index('R'))
```

d.
```
L=[1,2,3]
L*=3
print(L)
```

e.
```
list1=[10,20]
list2=[30,40]
list1.append(25)
print(list1)
list1.extend(list2)
print(list1)
```

Answers

Exercise (Section A)

A. 1. d 2. b 3. c 4. a 5. c 6. b 7. a 8. c 9. c 10. b
11. b 12. a 13. b 14. a 15. b

B. 1. program 2. sequential 3. True/False 4. step-by-step 5. interpreted
6. arithmetic 7. Single-line/Multi-line 8. type() 9. program 10. condition
11. two 12. entry-controlled loop or indefinite loop 13. heterogeneous
14. mutable 15. Forward Indexing

C. 1. False 2. True 3. True 4. True 5. False 6. False
7. False 8. True 9. False 10. True 11. False 12. True
13. False 14. False 15. True

Answer the following questions:

1. Create a Python list with the elements 1, 2, and 3 and replace the second element with 'Python'. Also, add element 5 at the end of the list.

2. Write a Python program that reverses a given sentence. For example, if the input is "Hello, World!", the program should output "!dlroW ,olleH".

PART-C

PRACTICAL WORK

&

PART-D

PROJECT WORK

Python Practical Questions

S. No.	Program

1.	To print personal information like Name, Father's Name, Class, School Name.
	`Name="Angelina"`
	`FName="Robert"`
	`Sclass=9`
	`Sch_Name="St. Joseph"`
	`print("***PERSONAL INFORMATION***")`
	`print("Student Name : ",Name)`
	`print("Father's Name : ",FName)`
	`print("Class : ",Sclass)`
	`print("School Name : ",Sch_Name)`
	Output:
	PERSONAL INFORMATION
	Student Name : Angelina
	Father's Name : Robert
	Class : 9
	School Name : St. Joseph

2	To print the following patterns using multiple print commands:
	a) `*`
	`**`
	`***`
	`****`
	b) `****`
	`***`
	`**`
	`*`
	Output:
	a)
	`print("*")`
	`print("**")`
	`print("***")`
	`print("****")`
	b)
	`print("****")`
	`print(" ***")`
	`print("  **")`
	`print("   *")`

3	To find square of number 7
	`N=7`
	`print("Square of ",N, " is : ",N**2)`
	`Output:`
	`Square of  7  is : 49`

S. No.	Program

4	To find the sum of two numbers 15 and 20.
	`N1=15`
	`N2=20`
	`print("The sum of two numbers is : ",N1+N2)`
	Output:
	The sum of two numbers is : 35

5	To convert length given in kilometers into meters.
	`Length=2.5`
	`print("Length given in kilometers is : ",Length," kms")`
	`print("Length converted in meters is : ",Length*1000," meters")`
	Output:
	Length given in kilometers is : 2.5 kms
	Length converted in meters is : 2500.0 meters

6	To print the table of 5 up to five terms.
	`N=5`
	`print("The table of 5 upto 5 terms are: ")`
	`print(N,"×",1,"=",N*1)`
	`print(N,"×",2,"=",N*2)`
	`print(N,"×",3,"=",N*3)`
	`print(N,"×",4,"=",N*4)`
	`print(N,"×",5,"=",N*5)`
	Output:
	The table of 5 upto 5 terms are:
	5 × 1 = 5
	5 × 2 = 10
	5 × 3 = 15
	5 × 4 = 20
	5 × 5 = 25

7	To calculate Simple Interest if the principle_amount = 2000 rate_of_interest = 4.5 time = 10
	`P=2000;R=4.5;T=10`
	`SI=(P*R*T)/100`
	`print("Simple Interest is : ",SI)`
	Output:
	Simple Interest is : 900.0

8	To calculate Area and Perimeter of a rectangle
	`Length=int(input("Enter Length : "))`
	`Breadth=int(input("Enter Breadth : "))`
	`print("Area of Rectangle is : ",Length*Breadth)`
	`print("Perimeter of Rectangle is : ",2*(Length+Breadth))`
	Output:
	Enter Length : 10
	Enter Breadth : 20
	Area of Rectangle is : 200
	Perimeter of Rectangle is : 60

S. No.	Program

9	To calculate Area of a triangle with Base and Height
	`Base=int(input("Enter Base : "))`
	`Height=int(input("Enter Height : "))`
	`print("Area of Triangle is : ",(1/2)*Base*Height)`
	Output:
	Enter Base : 10
	Enter Height : 15
	Area of Triangle is : 75.0

10	To calculating average marks of 3 subjects
	`Eng=float(input("Enter Eng Marks : "))`
	`Maths=float(input("Enter Maths Marks : "))`
	`Science=float(input("Enter Science Marks : "))`
	`print("Average of 3 subjects is : ",round((Eng+Maths+Science)/3,2))`
	Output:
	Enter Eng Marks : 90
	Enter Maths Marks : 95
	Enter Science Marks : 87
	Average of 3 subjects is : 90.67

11	To calculate discounted amount with discount %
	`Amt=int(input("Enter an Amount : "))`
	`Discount=int(input("Enter Discount : "))`
	`print("The discounted amount is : ",Amt-Discount)`
	`print("The discount % is : ",(Discount/Amt)*100)`
	Output:
	Enter an Amount : 100
	Enter Discount : 24
	The discounted amount is : 76
	The discount % is : 24.0

12	To calculate Surface Area and Volume of a Cuboid
	`Length=int(input("Enter Length : "))`
	`Breadth=int(input("Enter Breadth : "))`
	`Height=int(input("Enter Height : "))`
	`Volume=Length*Breadth*Height`
	`print("Volume of Cuboid is : ",Volume)`
	`Surface_Area=2*((Length*Breadth)+(Breadth*Height)+(Length*Height))`
	`print("Surface Area of Cuboid is : ",Surface_Area)`
	Output:
	Enter Length : 10
	Enter Breadth : 8
	Enter Height : 5
	Volume of Cuboid is : 400
	Surface Area of Cuboid is : 340

S. No.	Program

13	Create a list in Python of children selected for science quiz with following names- Arjun, Sonakshi, Vikram, Sandhya, Sonal, Isha, Kartik. Perform the following tasks on the list in sequence-
	a) Print the whole list
	b) Delete the name "Vikram" from the list
	c) Add the name "Jaya" at the end
	d) Remove the item which is at the second position.
	`Names=["Arjun", "Sonakshi", "Vikram", "Sandhya", "Sonal", "Isha", "Kartik"]`
	`print(Names)`
	`Names.remove("Vikram")`
	`print(Names)`
	`Names.append("Jaya")`
	`print(Names)`
	`Names.pop(1)`
	`print(Names)`
	Output:
	['Arjun', 'Sonakshi', 'Vikram', 'Sandhya', 'Sonal', 'Isha', 'Kartik']
	['Arjun', 'Sonakshi', 'Sandhya', 'Sonal', 'Isha', 'Kartik']
	['Arjun', 'Sonakshi', 'Sandhya', 'Sonal', 'Isha', 'Kartik', 'Jaya']
	['Arjun', 'Sandhya', 'Sonal', 'Isha', 'Kartik', 'Jaya']

14	Create a list num=[23,12,5,9,65,44]
	a) Print the length of the list
	b) Print the elements from second to fourth position using positive indexing
	c) Print the elements from position third to fifth using negative indexing
	`L1=[23,12,5,9,65,44]`
	`print(len(L1))`
	`print(L1[1:4])`
	`print(L1[-4:-1])`
	Output:
	6
	[12, 5, 9]
	[5, 9, 65]

15	Create a list of first 10 even numbers, add 1 to each list item and print the final list.
	`L1=[]`
	`for x in range(2,21,2):`
	`  L1.append(x)`
	`print(L1)`
	`for i in range(len(L1)):`
	`  L1[i]+=1`
	`print(L1)`
	Output:
	[2, 4, 6, 8, 10, 12, 14, 16, 18, 20]
	[3, 5, 7, 9, 11, 13, 15, 17, 19, 21]

S. No.	Program

16	Create a list List_1=[10,20,30,40]. Add the elements [14,15,12] using the extend function. Now sort the final list in ascending order and print it.
	`List_1=[10,20,30,40]`
	`List_1.extend([14,15,12])`
	`List_1=sorted(List_1)`
	`print(List_1)`
	Output:
	[10, 12, 14, 15, 20, 30, 40]

17	Program to check if a person can vote or not.
	`Age=int(input("Enter Age : "))`
	`if Age>=18:`
	`  print("The person can vote")`
	`else:`
	`  print("The person cannot vote")`
	`  print("Wait for ",18-Age, "years")`
	Output:
	Enter Age: 18
	The person can vote
	Enter Age: 15
	The person cannot vote
	Wait for 3 years

18	To check the grade of a student
	`marks=float(input("Enter marks out of hundred:\n"))`
	`if 90<=marks<=100:`
	`  print("Grade is A")`
	`elif 75<=marks<=89.9:`
	`  print("Grade is B")`
	`elif 60<=marks<=74.9:`
	`  print("Grade is C")`
	`elif 45<=marks<=59.5:`
	`  print("Grade is D")`
	`elif 33<=marks<=44.9:`
	`  print("Grade is E")`
	`elif 0<=marks<=32.9:`
	`  print("Grade is F")`
	`else:`
	`  print("Invalid Marks")`
	Output:
	Enter marks out of hundred:
	68
	Grade is C

S. No.	Program

19	Input a number and check if the number is positive, negative or zero and display an appropriate message
	`N=int(input("Enter a number: "))`
	`if N<0:`
	`  print(N," is a -ve number")`
	`elif N==0:`
	`  print(N," is entered")`
	`else:`
	`  print(N," is a +ve number")`
	Output:
	Enter a number: 5
	5 is a +ve number

20	To print first 10 natural numbers
	`for i in range(1,11):`
	`  print(i,end="!")`
	Output:
	1!2!3!4!5!6!7!8!9!10!

21	To print first 10 even numbers
	`for i in range(1,11):`
	`  print(2*i)`
	Output:
	2
	4
	6
	8
	10
	12
	14
	16
	18
	20

22	To print N odd numbers
	`N=int(input("Enter the term : "))`
	`for i in range(1,N+1):`
	`  print(2*i-1,end=",")`
	Output:
	Enter the term : 7
	1,3,5,7,9,11,13,

23	To print sum of first 10 natural numbers
	`S=0`
	`for i in range(1,11):`
	`  S+=i`
	`print("The sum is ",S)`
	Output:
	The sum is 55

24	Program to find the sum of all numbers stored in a list
	`S=0`
	`for i in [1,2,3,4,5]:`
	`  S+=i`
	`print("The sum is ",S)`
	Output:
	The sum is 15

Viva Voce Questions

1. What type of language is Python?

Ans. Python is a scripting language.

2. How is Python an interpreted language?

Ans. Python is an interpreted language because it executes code line by line at runtime without compiling into machine-level code beforehand.

3. What are Python modules?

Ans. Python modules are files containing Python code. This code can either be functions classes or variables. A Python module is a .py file containing executable code.

4. Name some commonly used built-in modules in Python.

Ans. Some of the commonly used built-in modules are:

a. os
b. sys
c. math
d. random
e. datetime
f. JSON

5. Is Python case-sensitive?

Ans. Yes, Python is a case-sensitive language.

6. Is indentation required in Python?

Ans. Indentation is necessary for Python. It specifies a block of code. All codes within loops, classes, functions, etc. are specified within an indented block. It is usually done using four space characters. If your code is not indented necessarily, it will not execute accurately and will throw errors as well.

7. How do you write comments in Python?

Ans. Comments in Python start with a # character. However, alternatively at times, commenting is done using docstrings (strings enclosed within triple quotes).

8. What is the purpose of is, not, and in operators?

Ans. Operators are special functions. They take one or more values and produce a corresponding result.

a. is: returns true when 2 operands are true (Example: "a" is 'a').
b. not: returns the inverse of the boolean value.
c. in: checks if some element is present in some sequence.

9. What does len() do?

Ans. It is used to determine the length of a string, a list, an array, etc.

10. Is Python an interpreted language?

Ans. Yes, Python is an interpreted language.

11. Is Python Object-Oriented Language?

Ans. Yes, Python is an Object-Oriented Language.

12. How many modes are available in Python?

Ans. Interactive mode and script mode.

13. Define Python?

Ans. Python is a high-level, interpreted, interactive and object oriented-scripting language.

14. Who developed Python?

Ans. Python was developed by Guido van Rossum in the late eighties and early nineties at the National Research Institute for Mathematics and Computer Science in the Netherlands.

15. Why Python is easy-to-learn?

Ans. Python has relatively few keywords, a simple structure, and a clearly defined syntax. This allows the student to pick up the language in a relatively short period of time.

16. Explain the disadvantages of Python.

Ans. Disadvantages of Python are:

a. Python is an interpreted language and is slow compared to C/C++ or Java.

b. Python is not the best for memory-intensive tasks.

17. Can Python be easily integrated with C++?

Ans. Yes, Python can be easily integrated with C++.

18. What is another name of comparison operators?

Ans. Relational operators.

19. Which operator is used for assigning a value to a variable?

Ans. Assignment operators.

20. Which operator is used for comparison of values?

Ans. Comparison operators.

21. What is the use of the "+" operator?

Ans. The "+" operator adds values on either side of the operator.

22. What is the use of the "*" operator?

Ans. The "**" operator multiplies values on either side of the operator.

23. What is the use of "%" operator?

Ans. The "%" operator divides the left-hand operand by the right-hand operand and returns the remainder.

24. What is the use of "**" operator?

Ans. The "*" operator performs exponential (power) calculation on operators.

25. What is the use of the "==" operator?

Ans. It checks if the value of two operands is equal or not. It returns True if the values are equal, otherwise False.

26. What is the use of the "!=" operator?

Ans. It checks if the value of two operands is equal or not, if values are not equal then condition becomes true.

27. Why do you use the "<>" operator?

Ans. The "<>" operator historically was used in some programming languages, including older versions of Python, to denote inequality. However, in Python, the preferred and standard operator for inequality is "!=" (not equal to).

28. Describe the use of the ">" operator.

Ans. It checks if the value of the left operand is greater than the value of the right operand, if yes then condition becomes true.

29. Why you use the "<" operator?

Ans. The "<" operator checks if the value of the left operand is less than the value of the right operand, if yes then condition becomes true.

30. Write syntax for the "greater than or equal to" operator.

Ans. a>= b.

31. Is "<" an Assignment operator?

Ans. No,"<" is not an assignment operator. As, it is a relational operator.

32. Optimise these statements as a Python programmer.

a. word 'word'

b. print word. len()

Ans. a. word = 'word'

b. print len(word)

33. How many types of operations are supported by the Python language?

Ans. Python language supports the following types of operations.

a. Arithmetic operations
b Comparison (i.e., Relational) operations
c. Assignment operations
d. Logical operations
e. Bitwise operations
f. Membership operations
g. Identity operations

34. Why do you use the 'break' statement?

Ans. The 'break' statement can be used to terminate the loop.

35. Write the syntax of an 'if' statement in Python programming language.

Ans. The syntax of an 'if' statement in Python programming language is:

```
if (condition):
    Statements
```

36. Write the syntax of an if.....else statement in Python programming language.

Ans. The syntax of an if.....else statement in Python programming language is:

```
if (condition):
    Statements for True
else:
    Statements for False
```

37. Define while loop.

Ans. A while loop statement in Python programming language repeatedly executes a target statement as long as a given condition is true.

38. Write the syntax of a while loop.

Ans. The syntax of a while loop in Python programming language is:

```
while <condition>
    Statements
```

39. What happens when the condition of the while loop becomes false?

Ans. When the condition becomes false, program control passes to the line immediately following the loop.

40. How can a programmer take user input in Python?

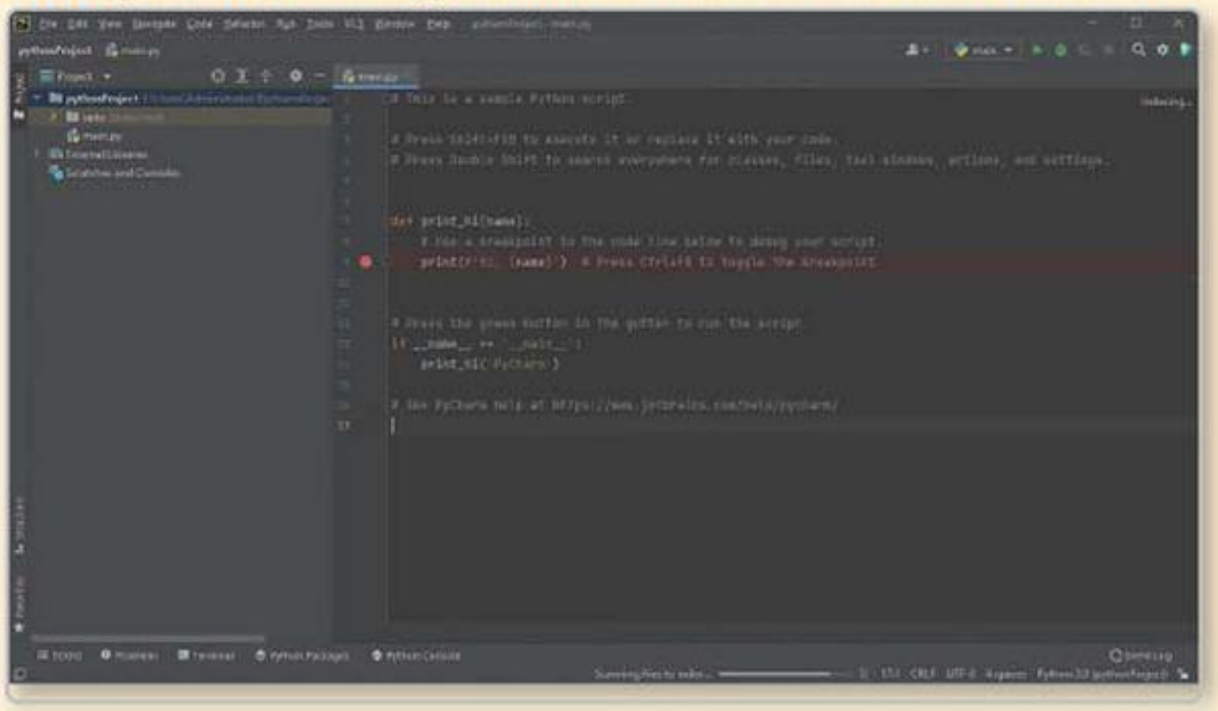
Ans. A programmer can take user input in Python using the input() function.

IDEs for Python

IDEs have the ability to understand the code better than code editors and apart from handling the code they also provide some additional features like debugging, execution, testing, etc. Let us now learn about some of the frequently used IDEs for Python.

Pycharm

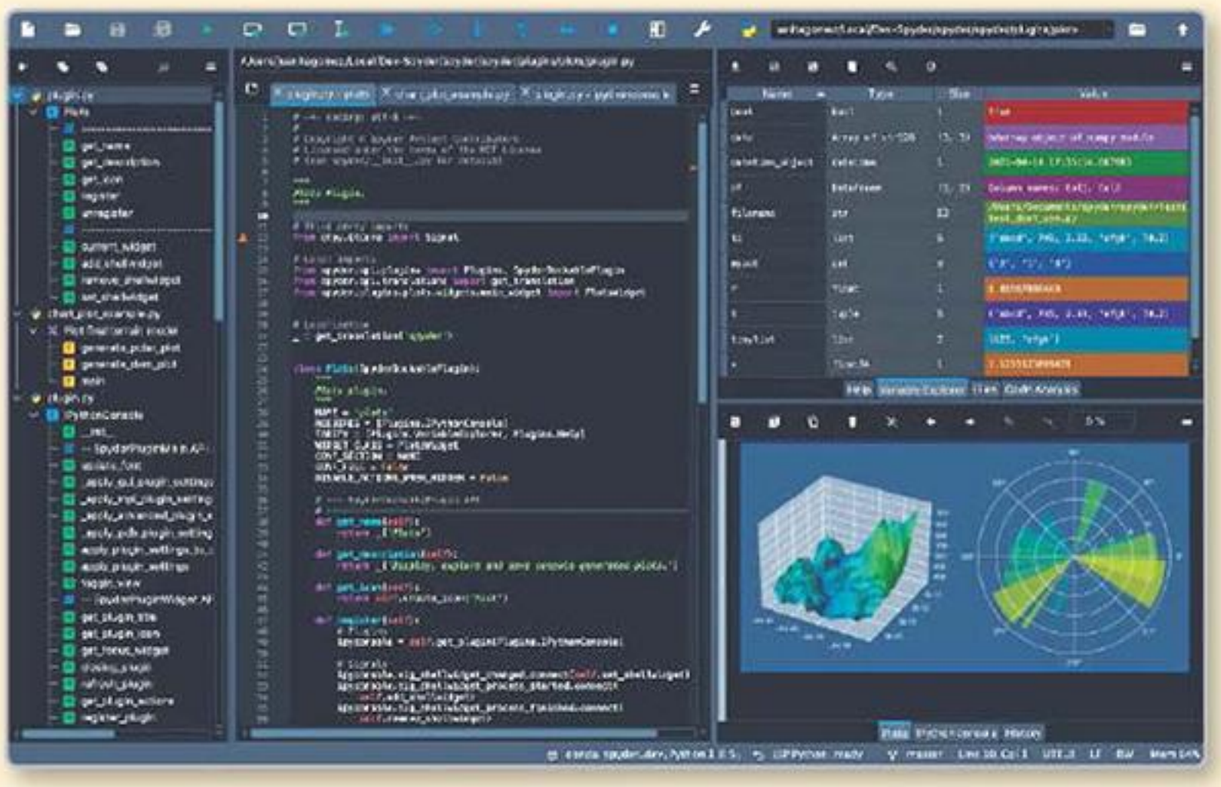
Most of the professional developers use PyCharm and it is considered the best IDE for python developers. It contains some good features such as Intelligent Code Editor for smart code completion and quick-fixes, Debugging, Testing and Profiling tools, VCS, Deployment & Remote Development, etc. To install PyCharm, visit the following link: https://www.jetbrains.com/pycharm/download/#section=windows



Spyder

Spyder is an open-source and cross-platform IDE written in Python. It is also known as Scientific Python Development IDE and it is the most lightweight IDE for Python. It is frequently used by data scientists who can integrate with Matplotlib, SciPy, NumPy, Pandas, Cython, IPython, SymPy, and other open-source software. To install Spyder, visit the following link:

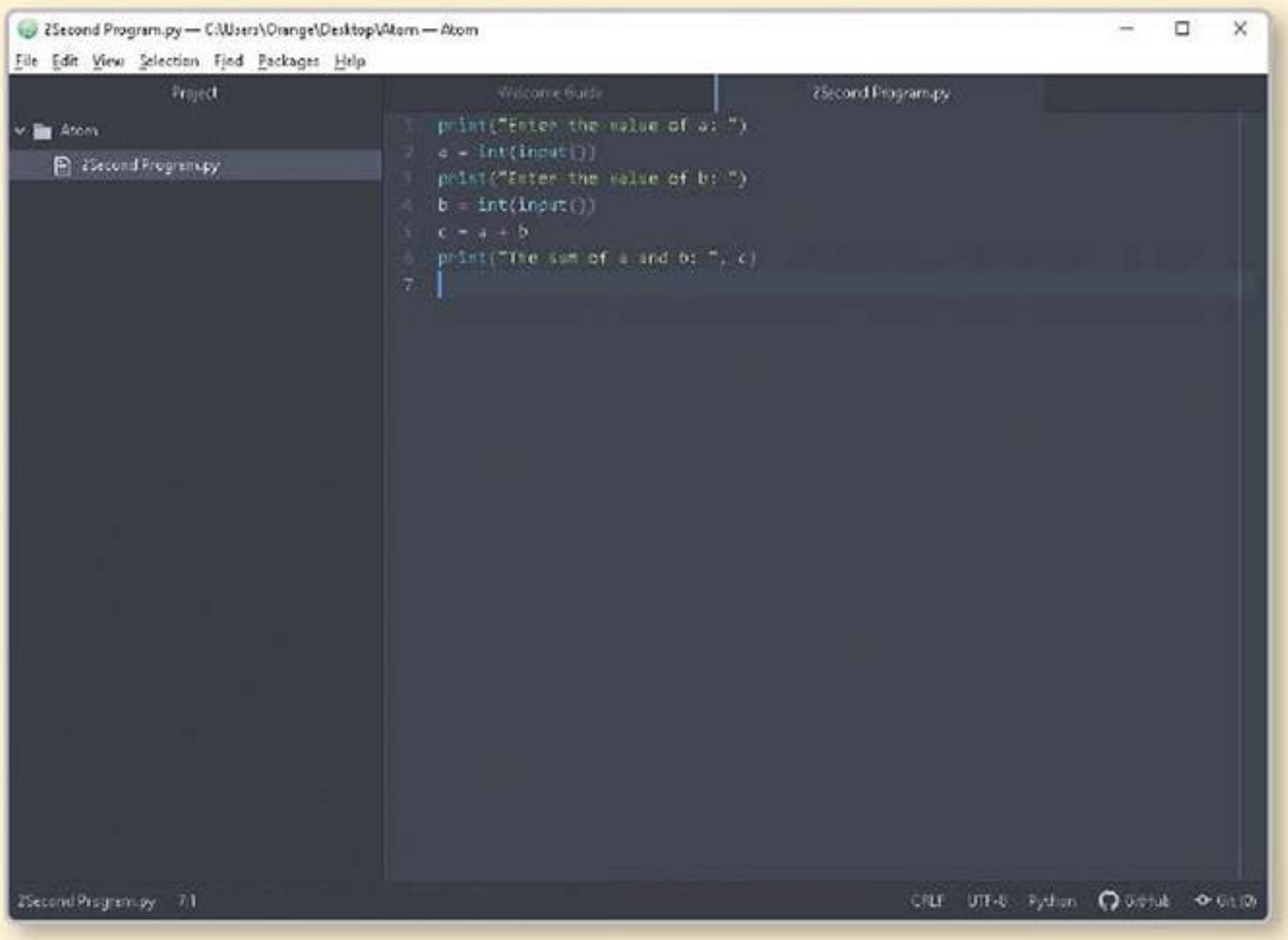
https://www.spyder-ide.org/



ATOM

Atom is an open-source cross-platform IDE built using web technologies. It is highly customisable and provides Python language supports installing the extension when Atom is running. Some of the useful packages for Python development are atom-python-run, Python Black, python-indent, atom-python-test, autocomplete-python, Python Tools, linter-flake8, python-debugger, etc. To install Atom, visit the following link:

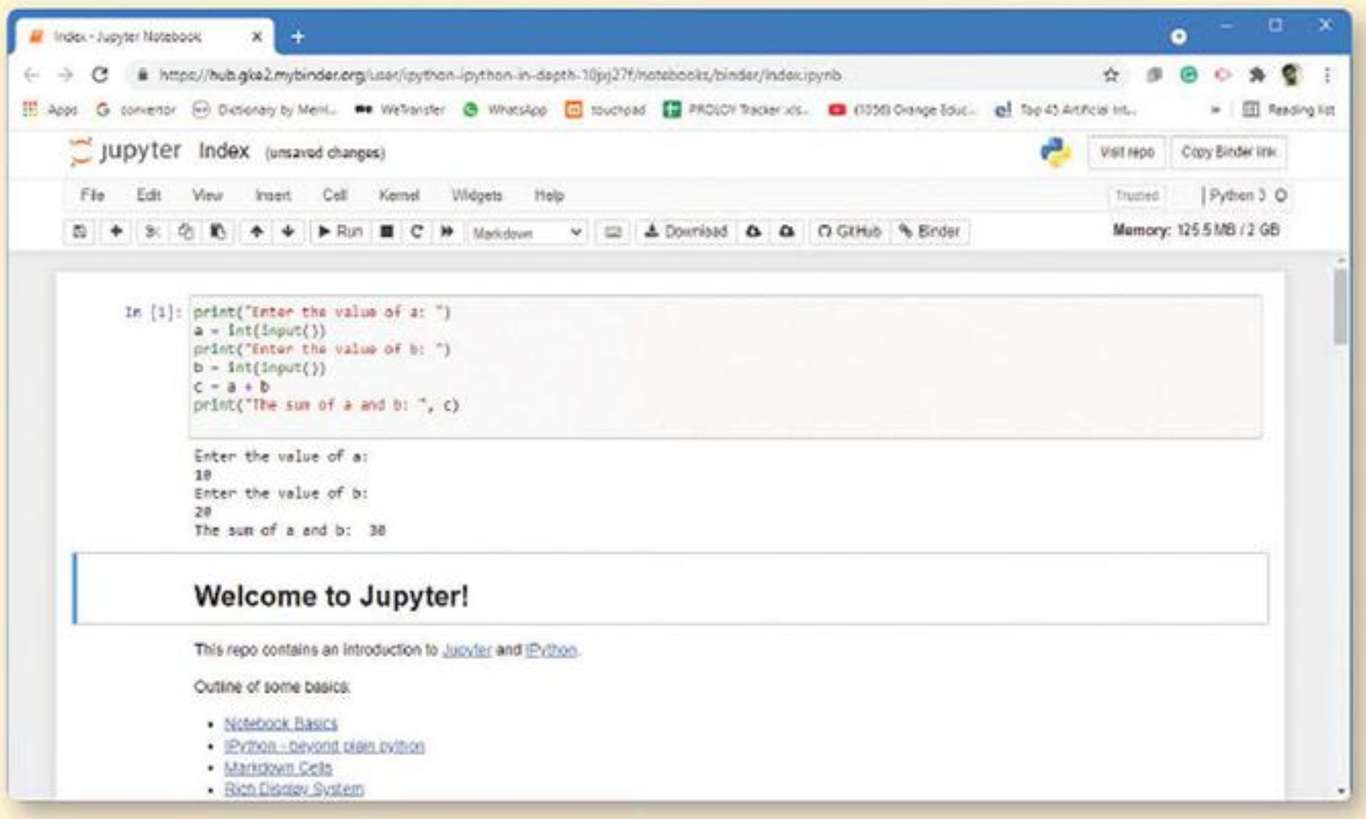
https://atom.io/



Jupyter Notebook

Jupyter Notebook is a web-based interactive development environment. It is popular in the data science community for analysing, sharing and presenting information. It is easy-to-use, open-source software that allows you to create and share live code, visualisations, etc. To install Jupyter Notebook, visit the following link:

https://jupyter.org/



PROJECTS

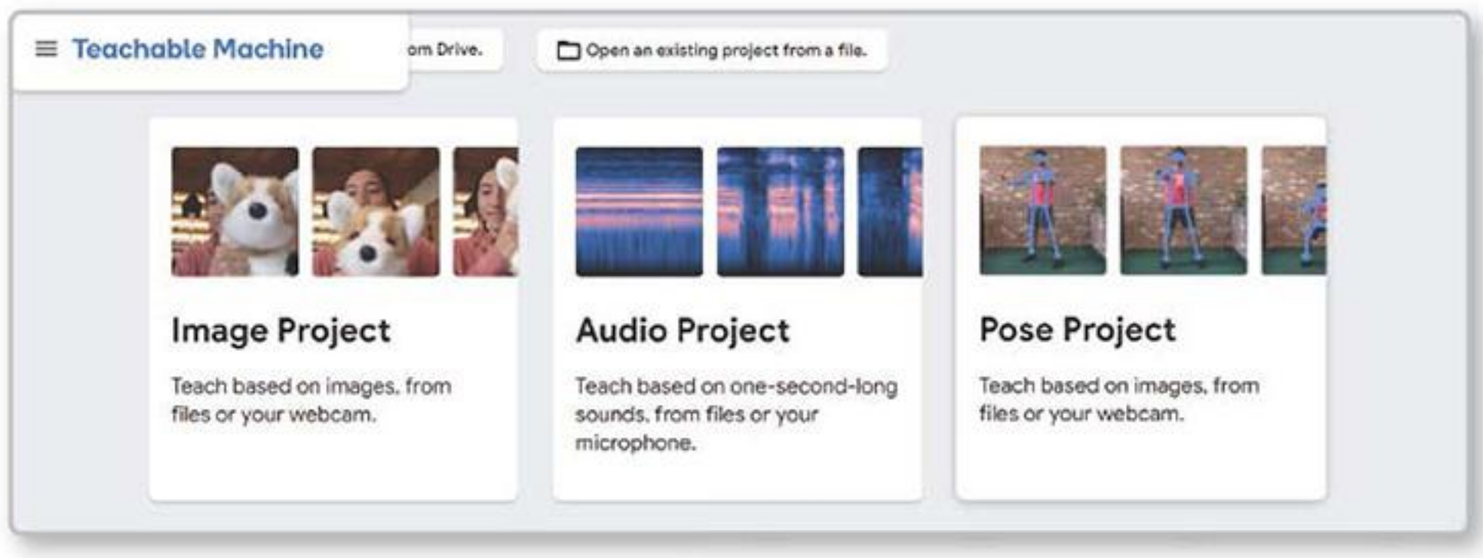
(Hints for Part D)

1. Create an AI model to classify images using tools: [CBSE]

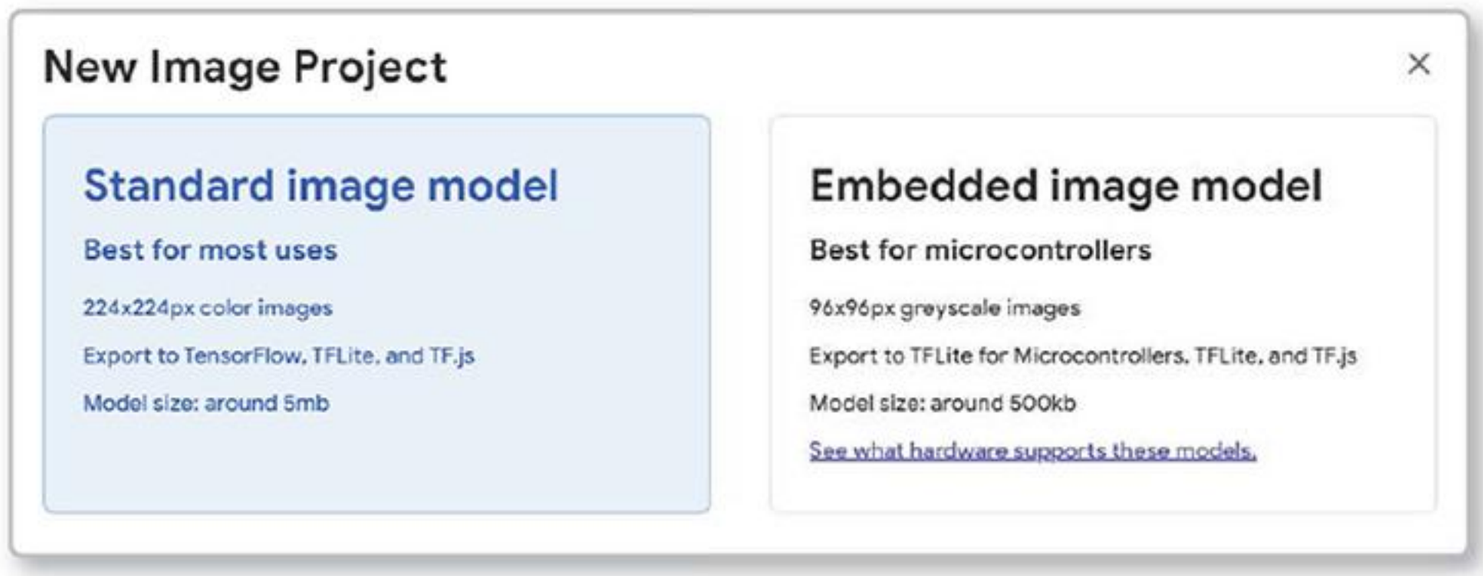
1.1. Using Teachable Machine

Step 1 Visit https://teachablemachine.withgoogle.com/ and click Get Started.

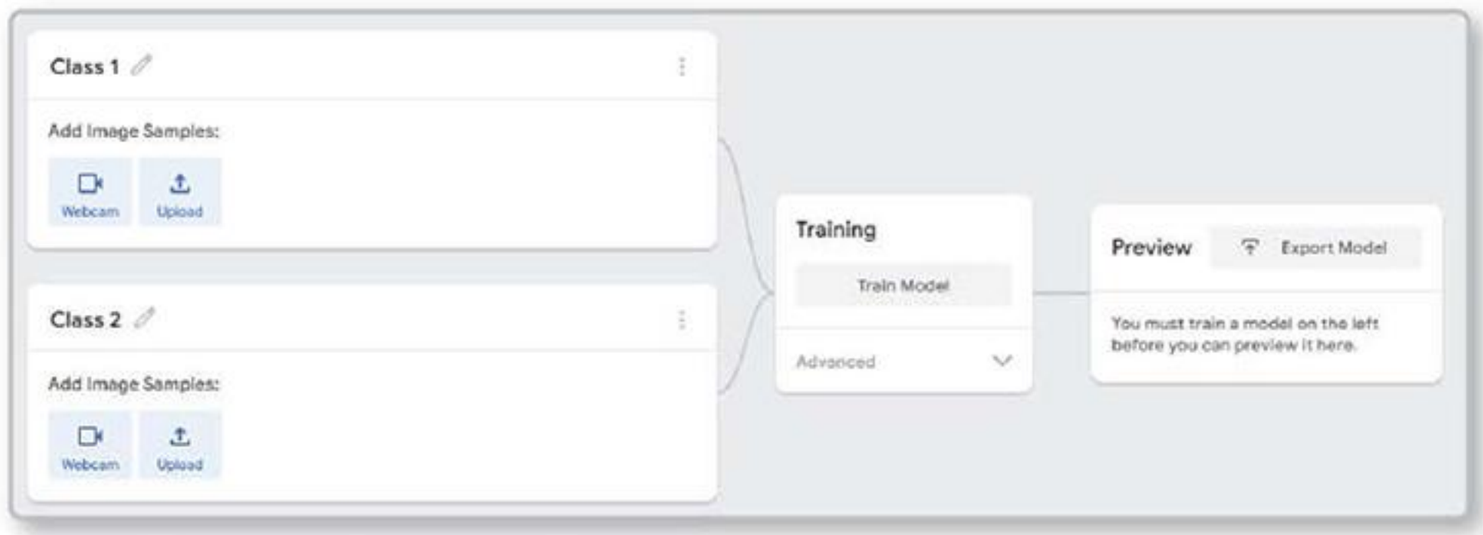
Step 2 Select the Image Project option.



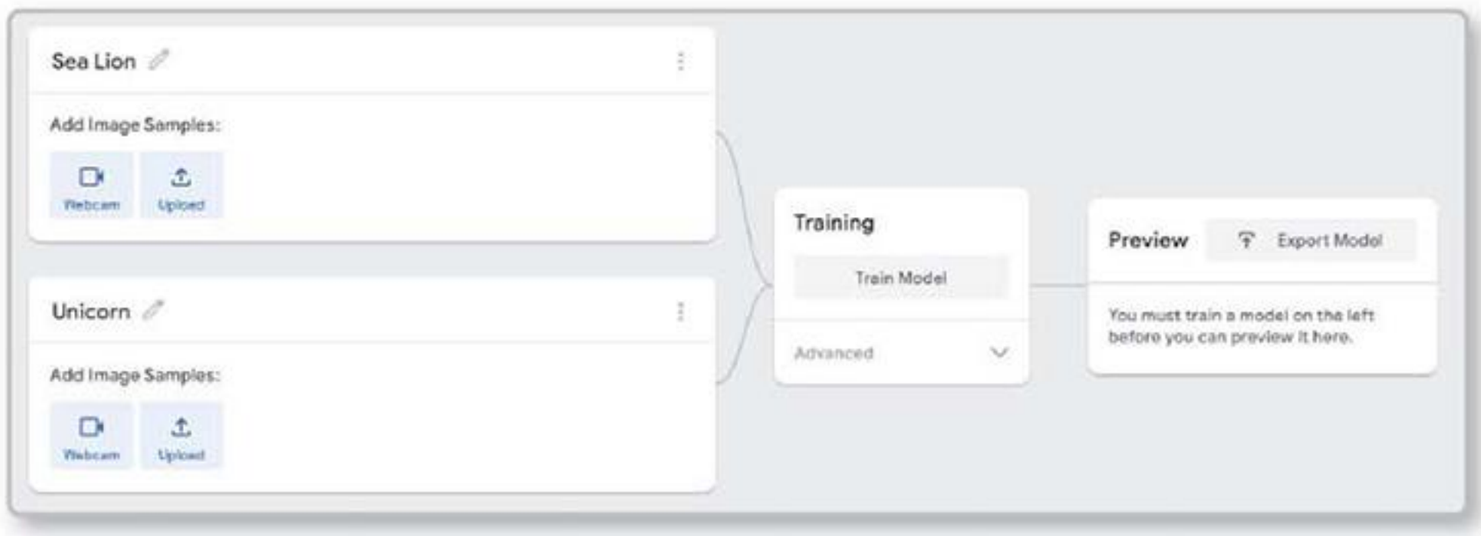
Step 3 The next screen gives you the option to select Standard image model or Embedded image model. It's recommended that you select the Standard image model, as that gives you a better resolution option.



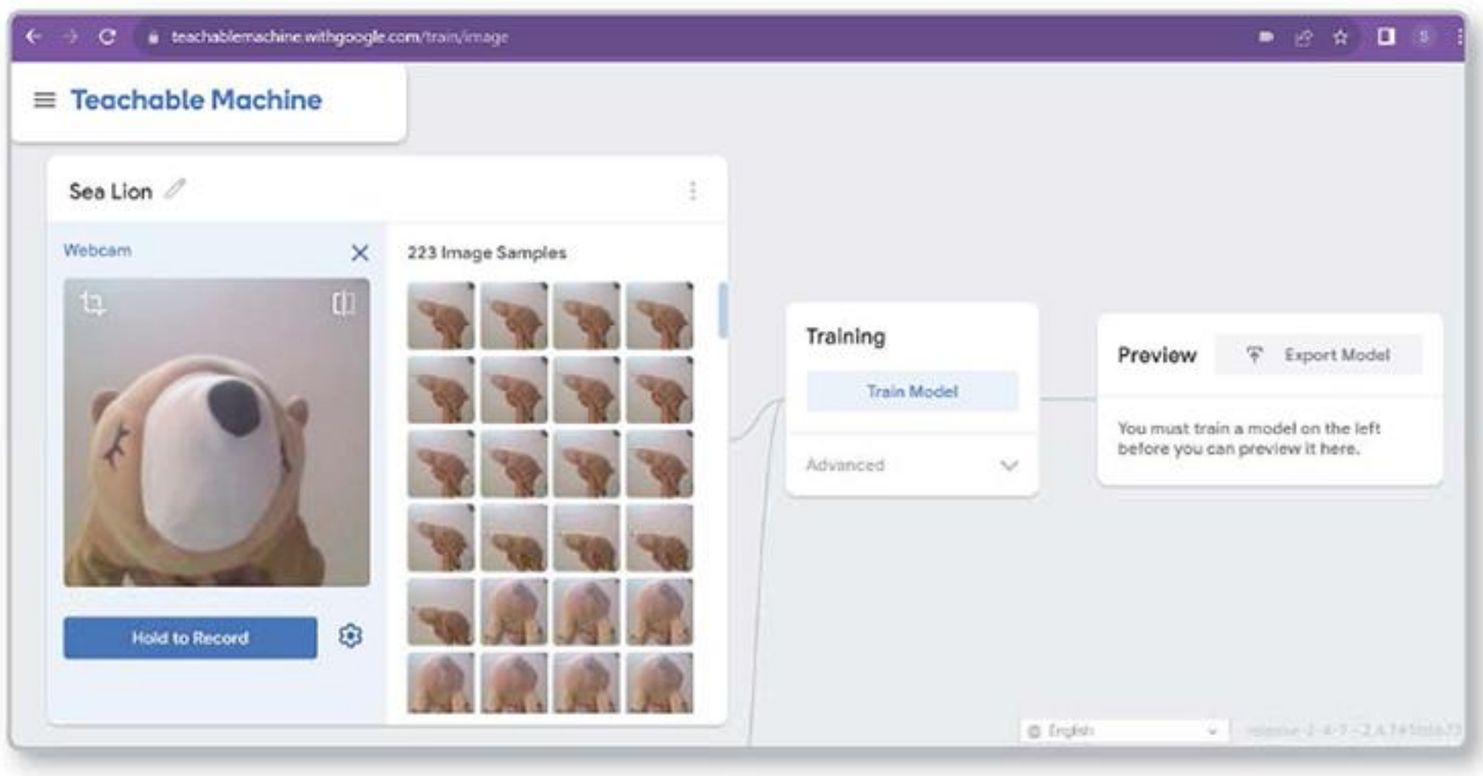
Step 4 The next screen gives you the option to name the two classes, which ideally would be the name of the subjects or objects or elements that you want to run the ML on and train the model.



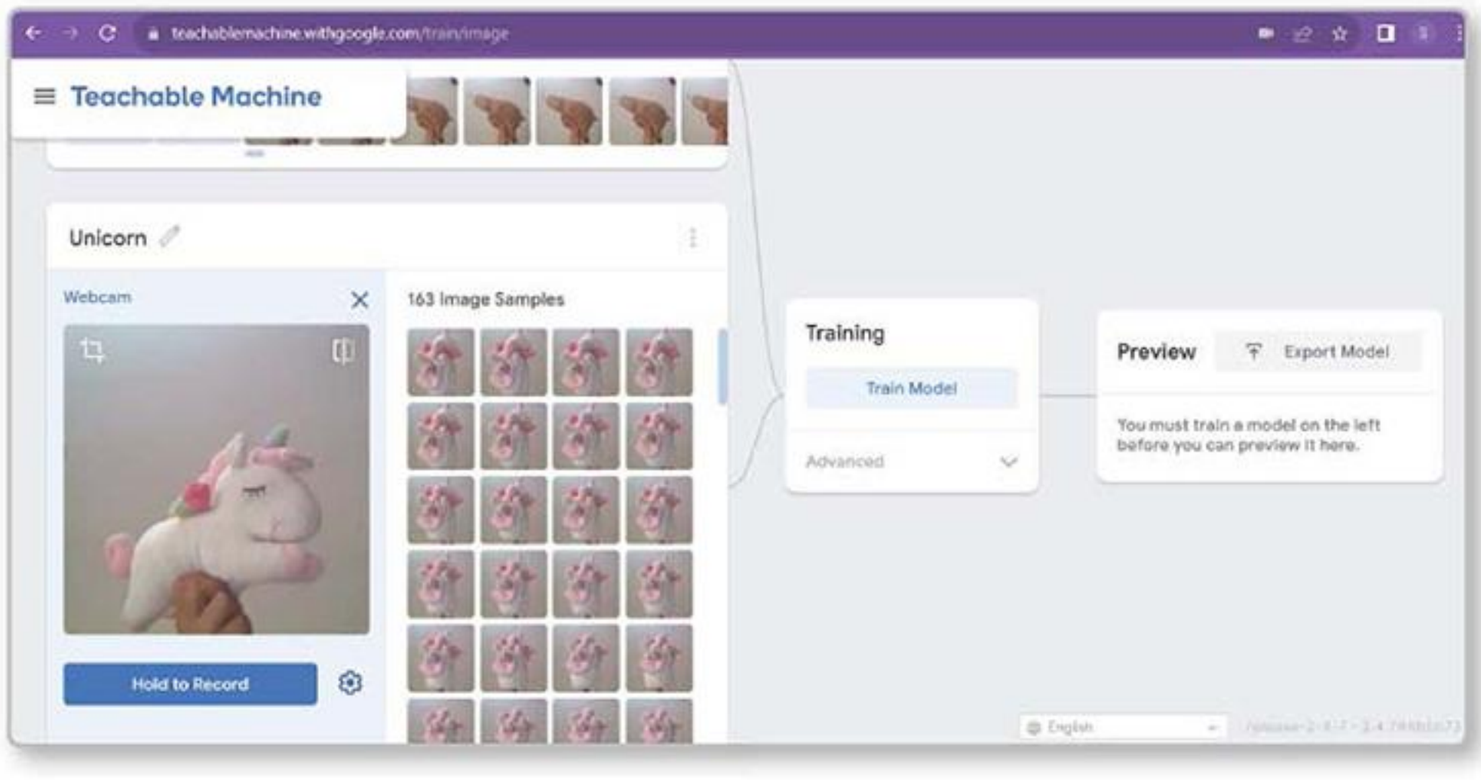
Step 5 So, today we have subjects for comparing Sea Lion and Unicorn. We go ahead and name the two classes, respectively.



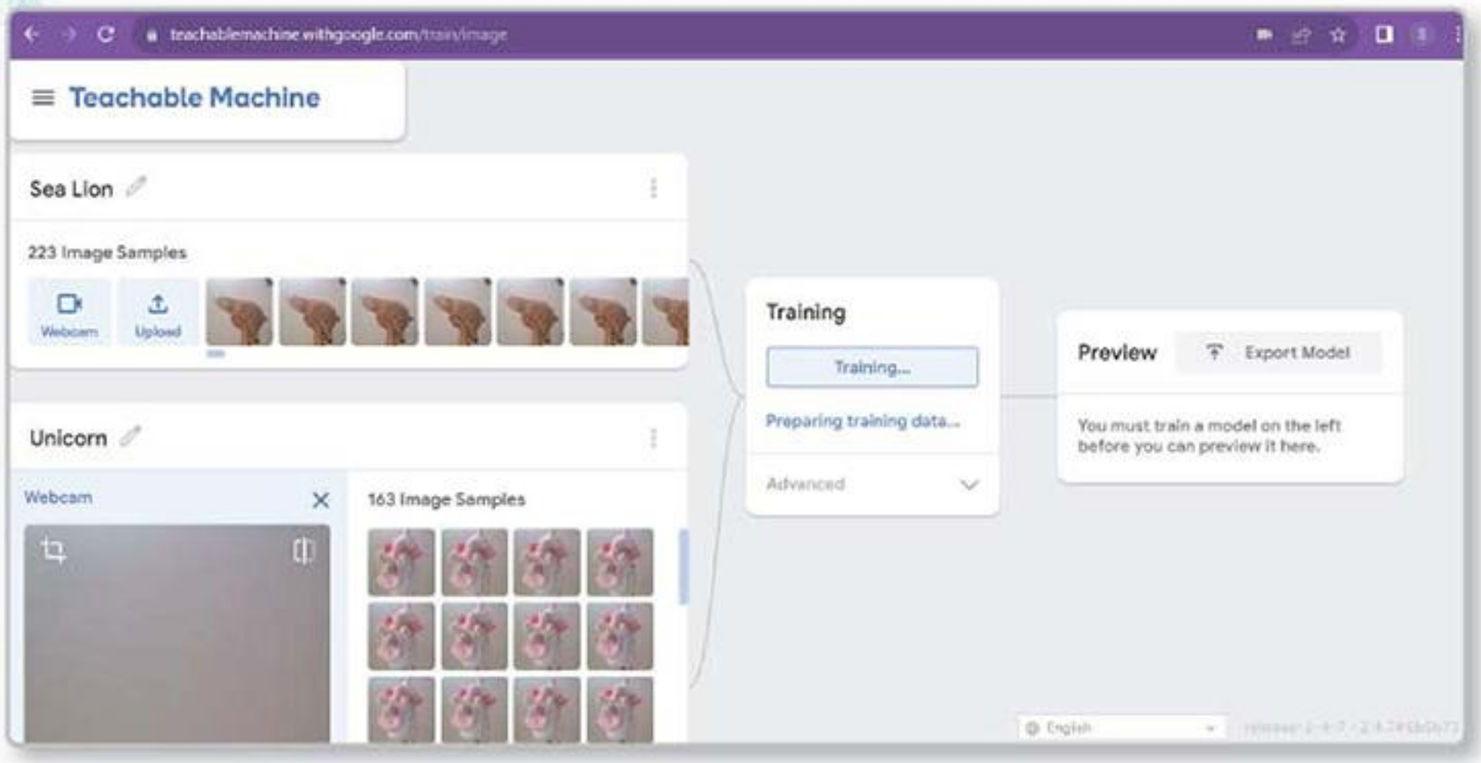
Step 6 Once we have named the class, we need to get the subject clicked for the model to run ML on. So, either we can use a webcam and get the required pictures clicked by just holding the key "Hold to Record" and let the system create its own image bank. We just have to keep moving the subject so that the system can capture images from all sides. We can also upload images of the subject if we have it all with us on the system or Google Drive.



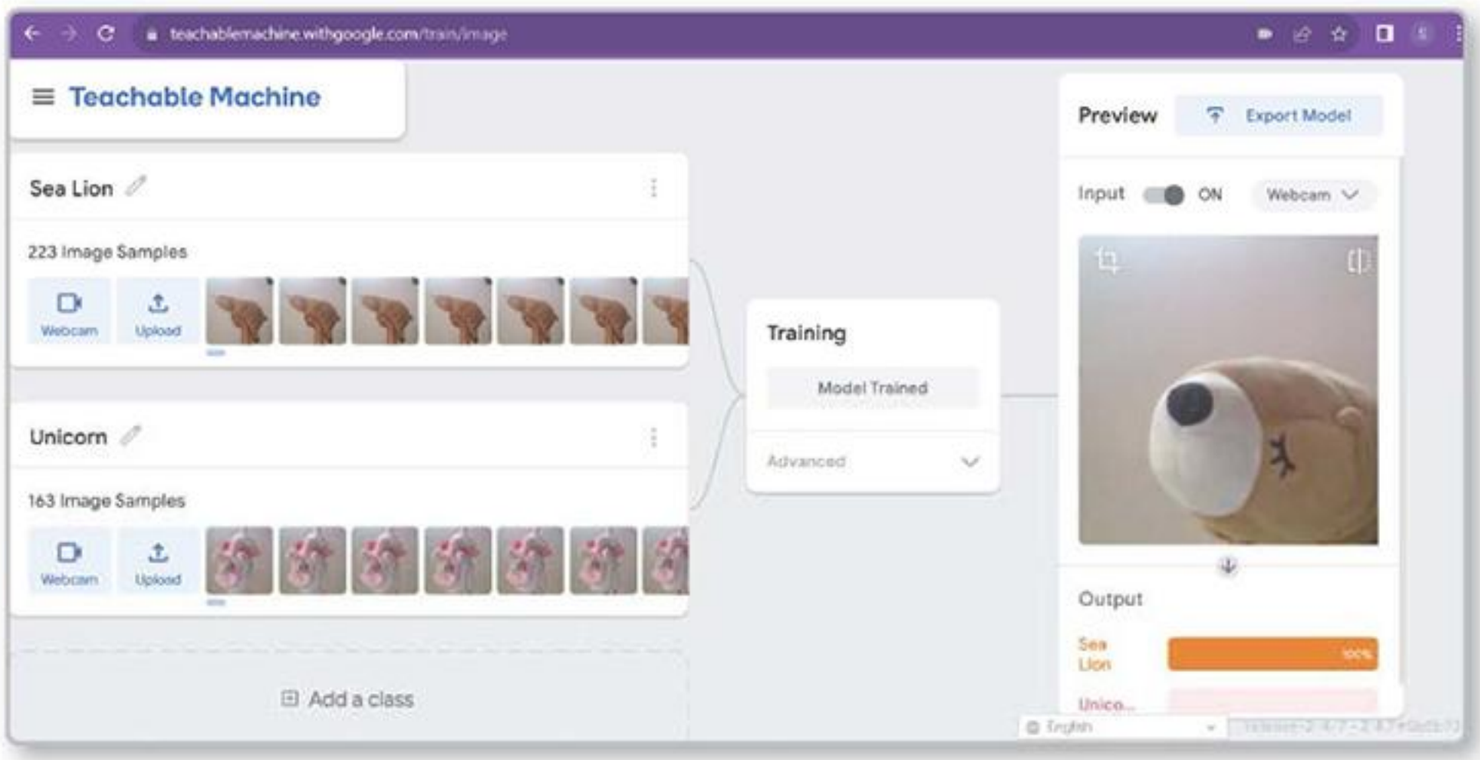
Step 7 Likewise, as in Step 6, we do the same with class 2, which is Unicorn in this case.



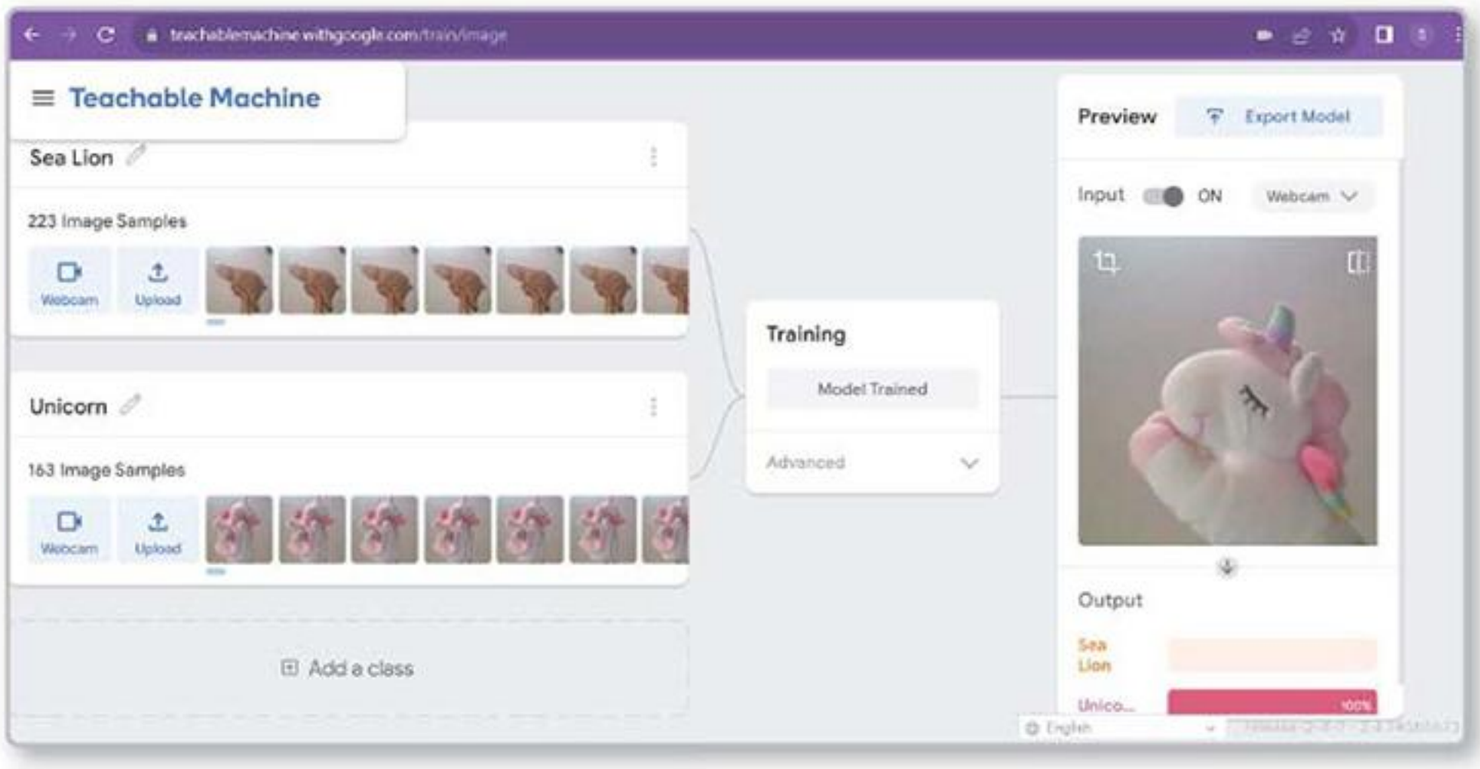
Step 8 Once we have got the sample images of both the class and subject, we click the button "Train Model" in the window with the heading Training. This starts the process of training the model.



Step 9 Once the model is trained, the message will change to "Model Trained". Now the model is ready for testing. So, once we bring any of the subjects in front of the camera in any position, the output of the model would be able to identify what the subject is. It would reflect in percentage as to how much percent it is able to identify the subject in comparison to the images which were used for training the model.

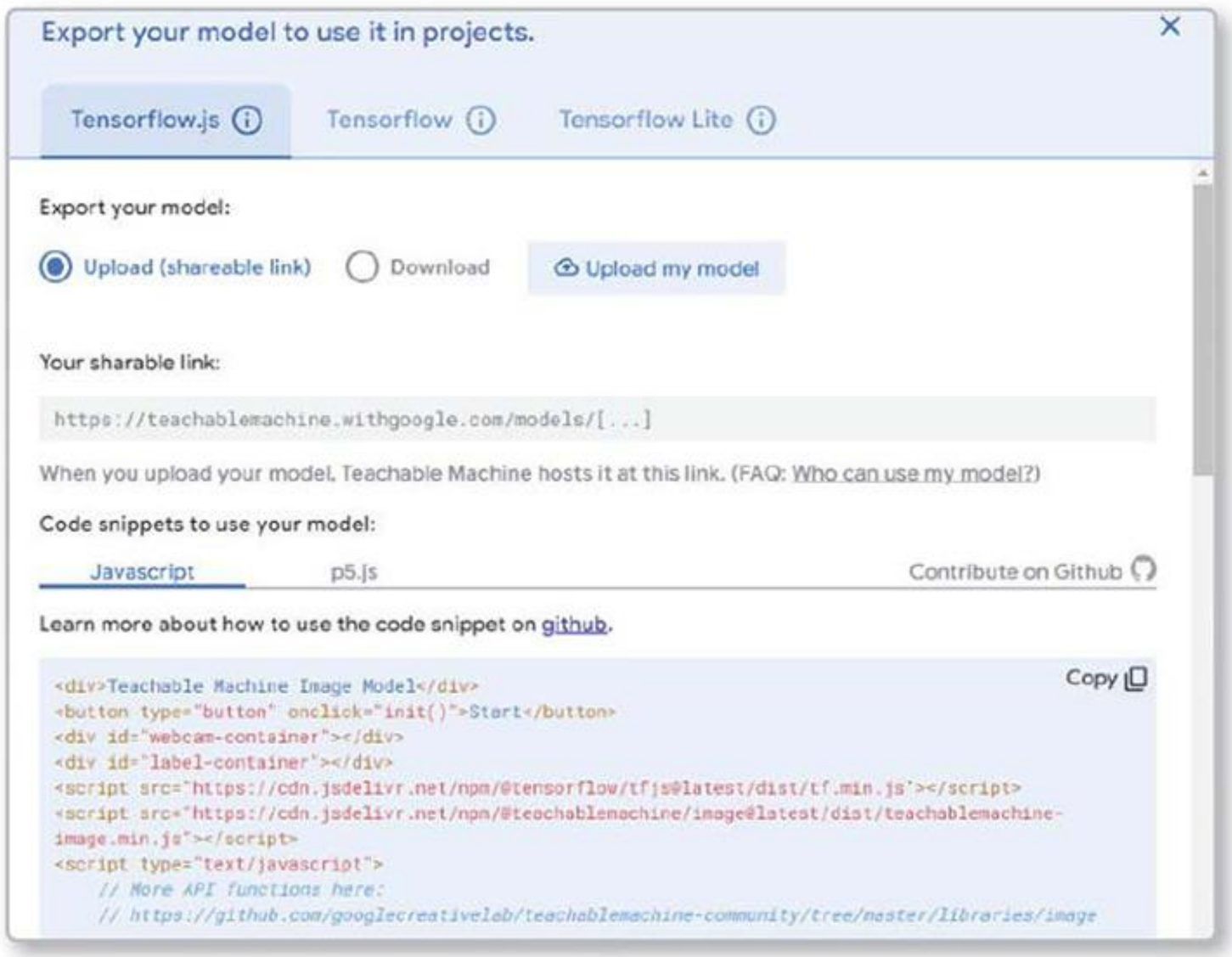


Step 10 We can test the system with the other subjects also, like we did in Step 9.



Step 11 The code of the Project that we created can be exported by clicking the Export Model button:

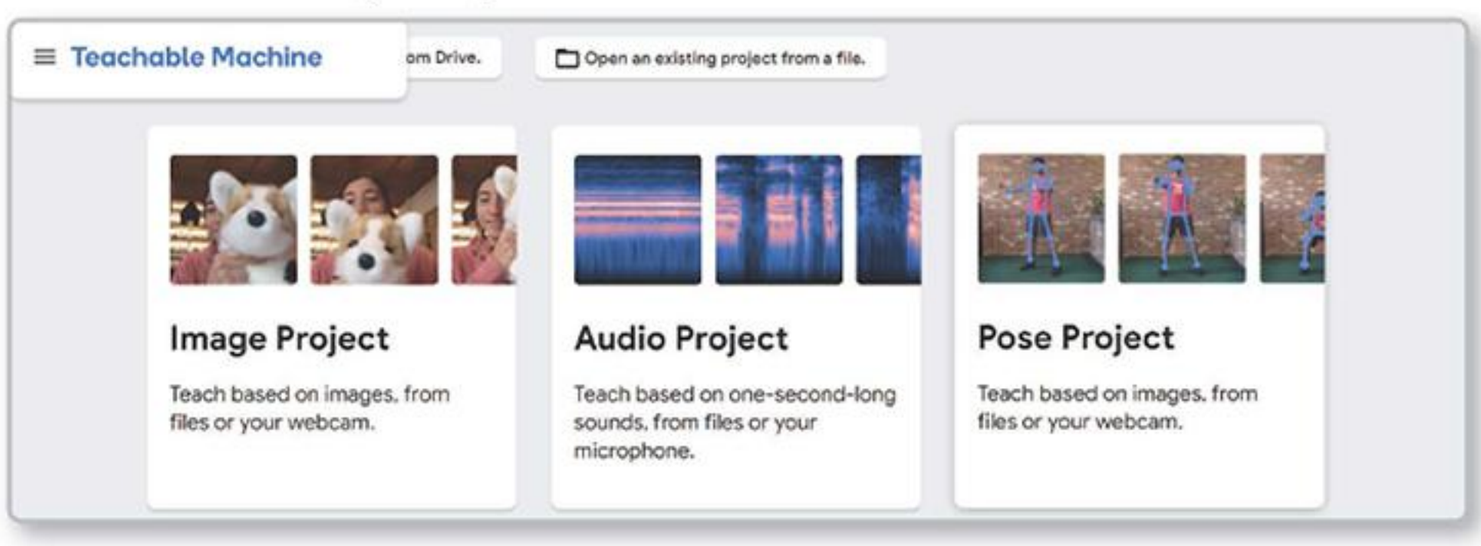
Step 12 Once we click on Export Model button, it opens up the window which gives you the option to get the shareable link of it or to Download the code, which could be embedded on the website of yours.



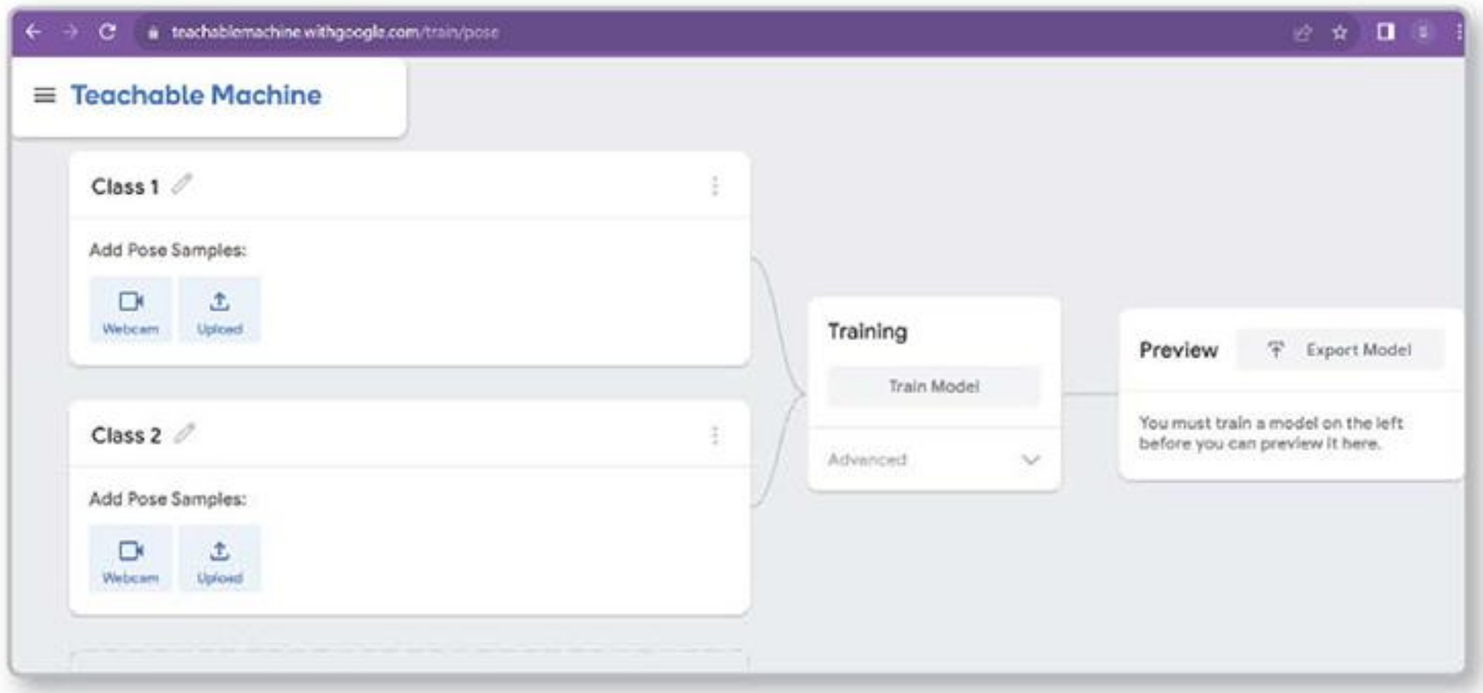
1.2 Teachable Machines Project using Pose

Step 1 Visit https://teachablemachine.withgoogle.com/ and click Get Started.

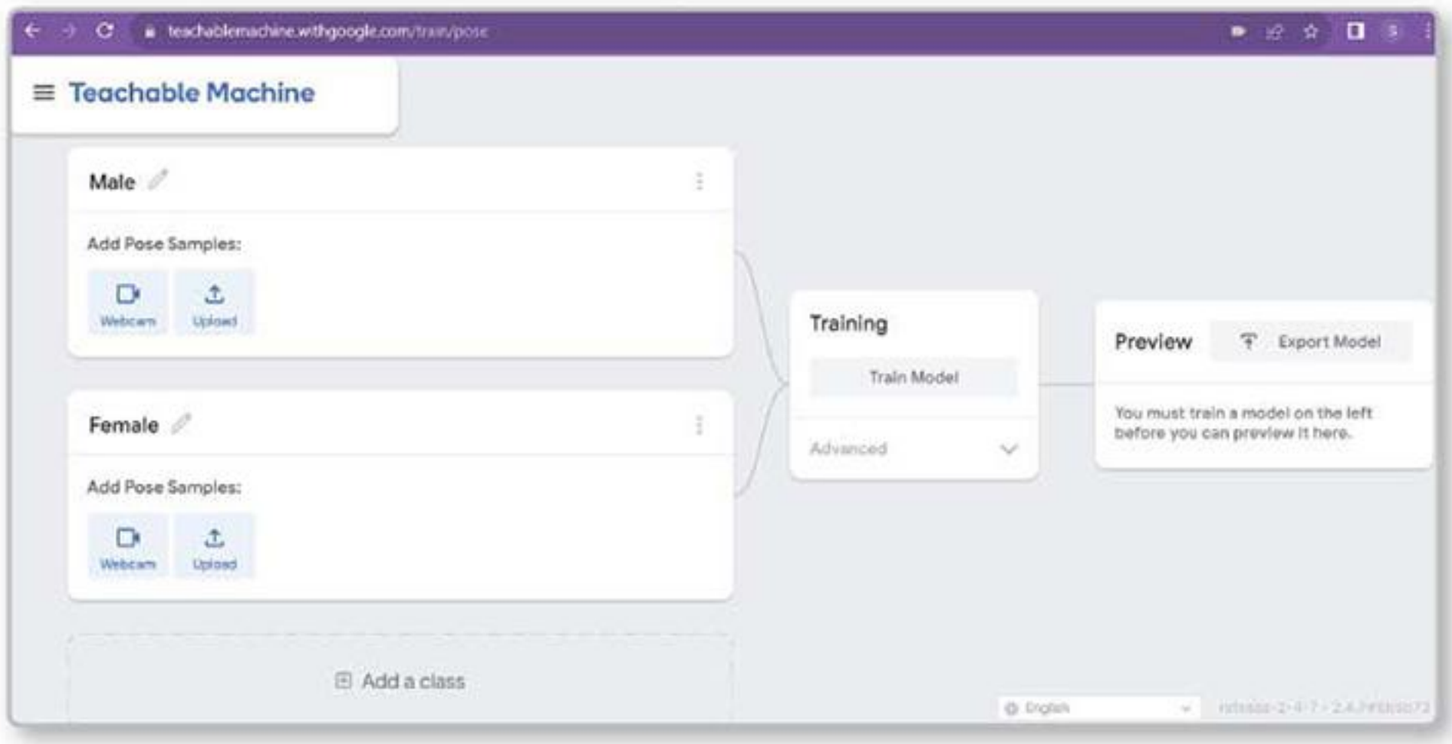
Step 2 Select the Pose Project option.



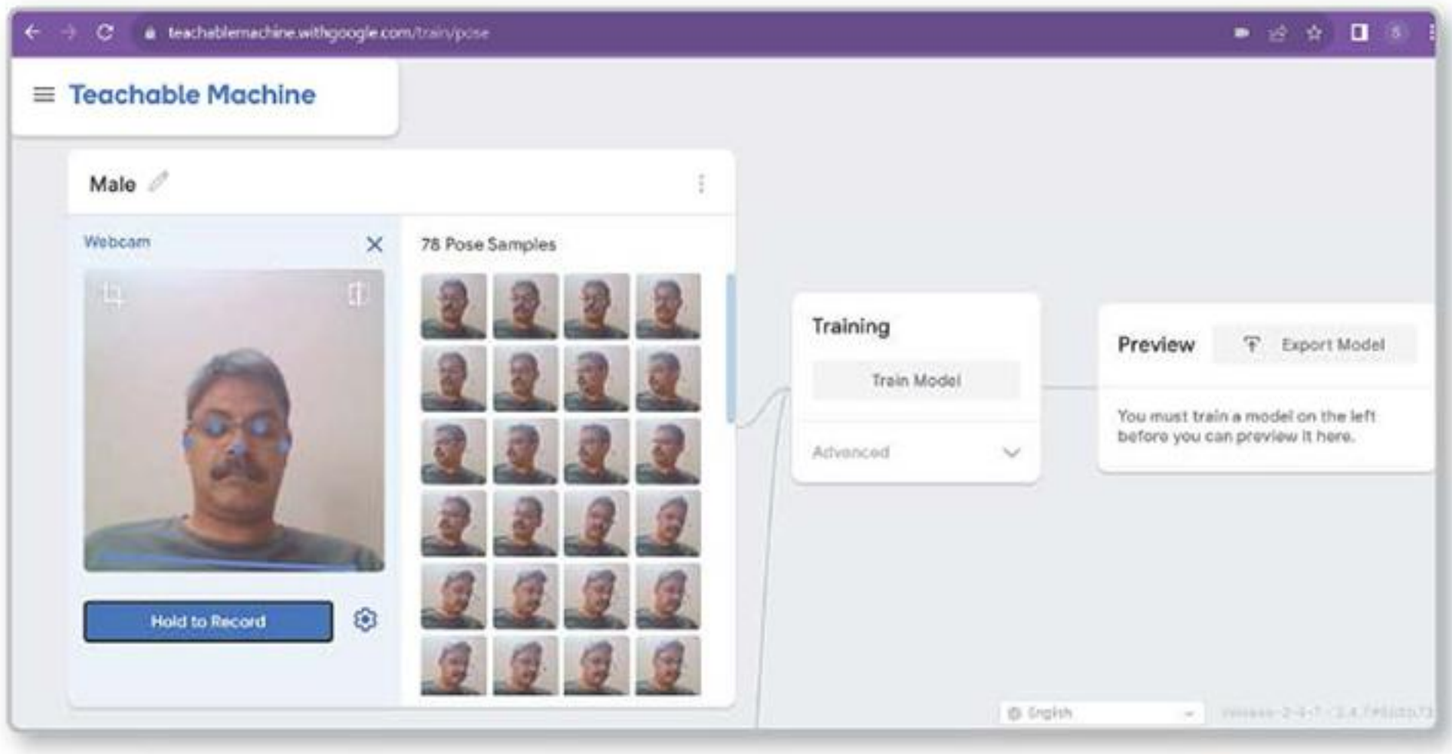
Step 3 The next screen gives you the option to name the two classes, which ideally would be the name of the subjects or objects or elements that you want to run the ML on and train the model.



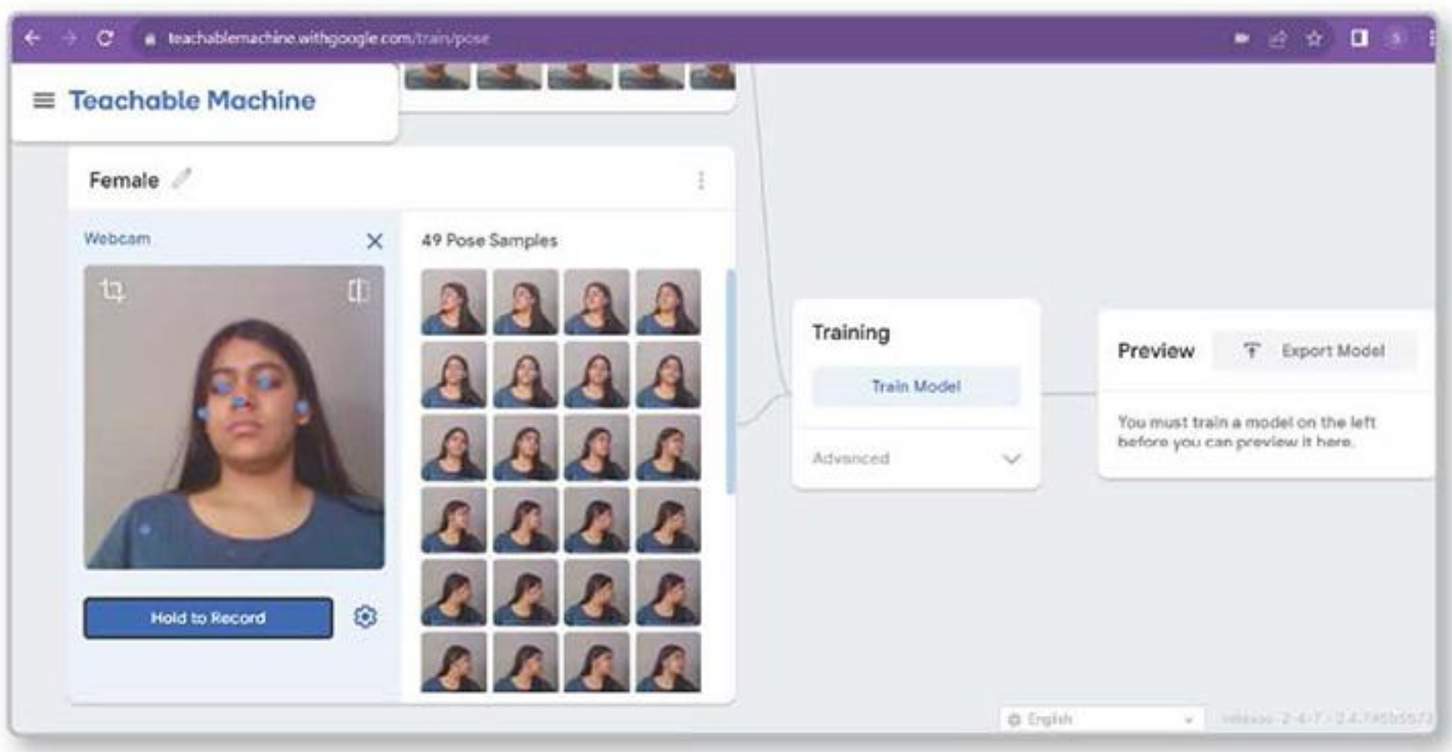
Step 4 Today we will be comparing Male and Female. We go ahead and name the two classes respectively.



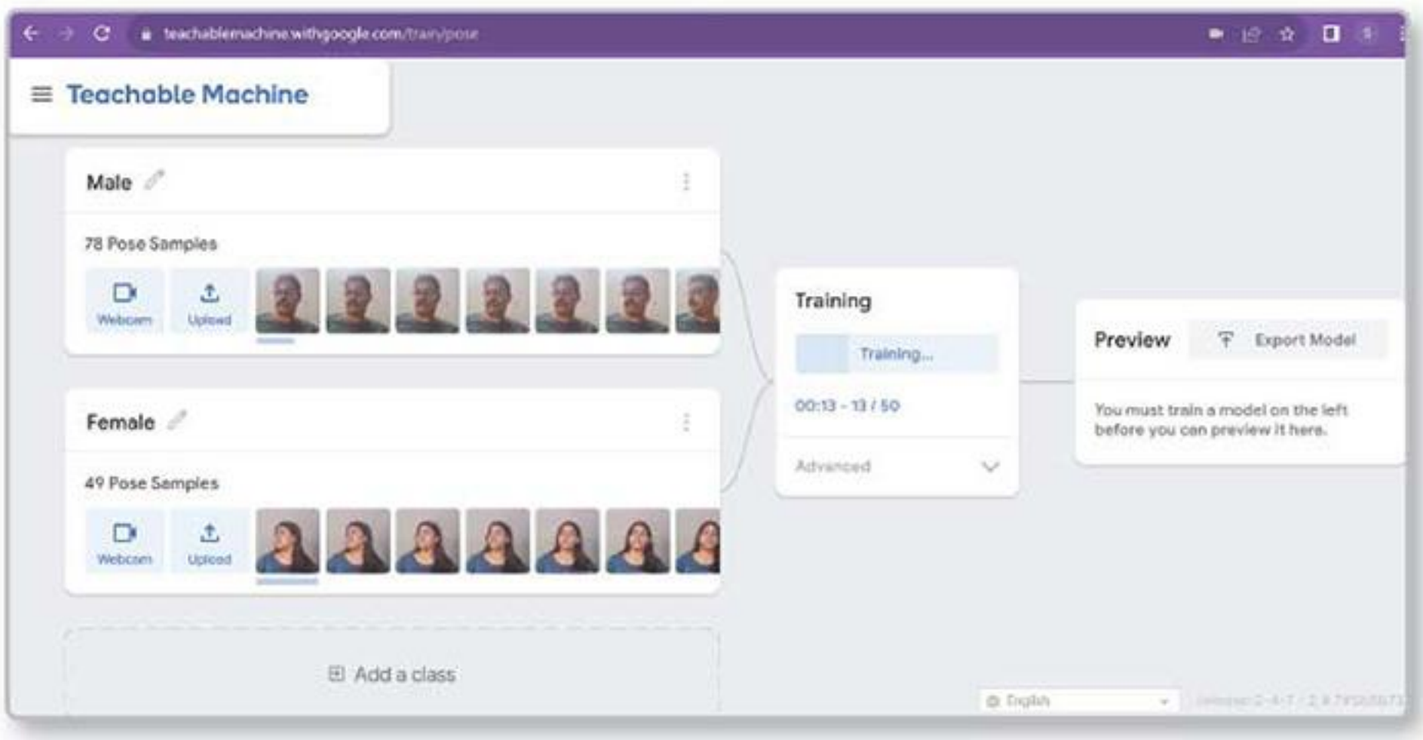
Step 5 Once we have named the class, we need to get the subject clicked for the model to run ML on. So either we can use a webcam and get the required pictures clicked by just holding the key "Hold to Record" and let the system create its own image bank. We just have to keep moving the subject so that the system can capture images from all sides. We can also upload images of the subject if we have it all with us on the system or Google Drive.



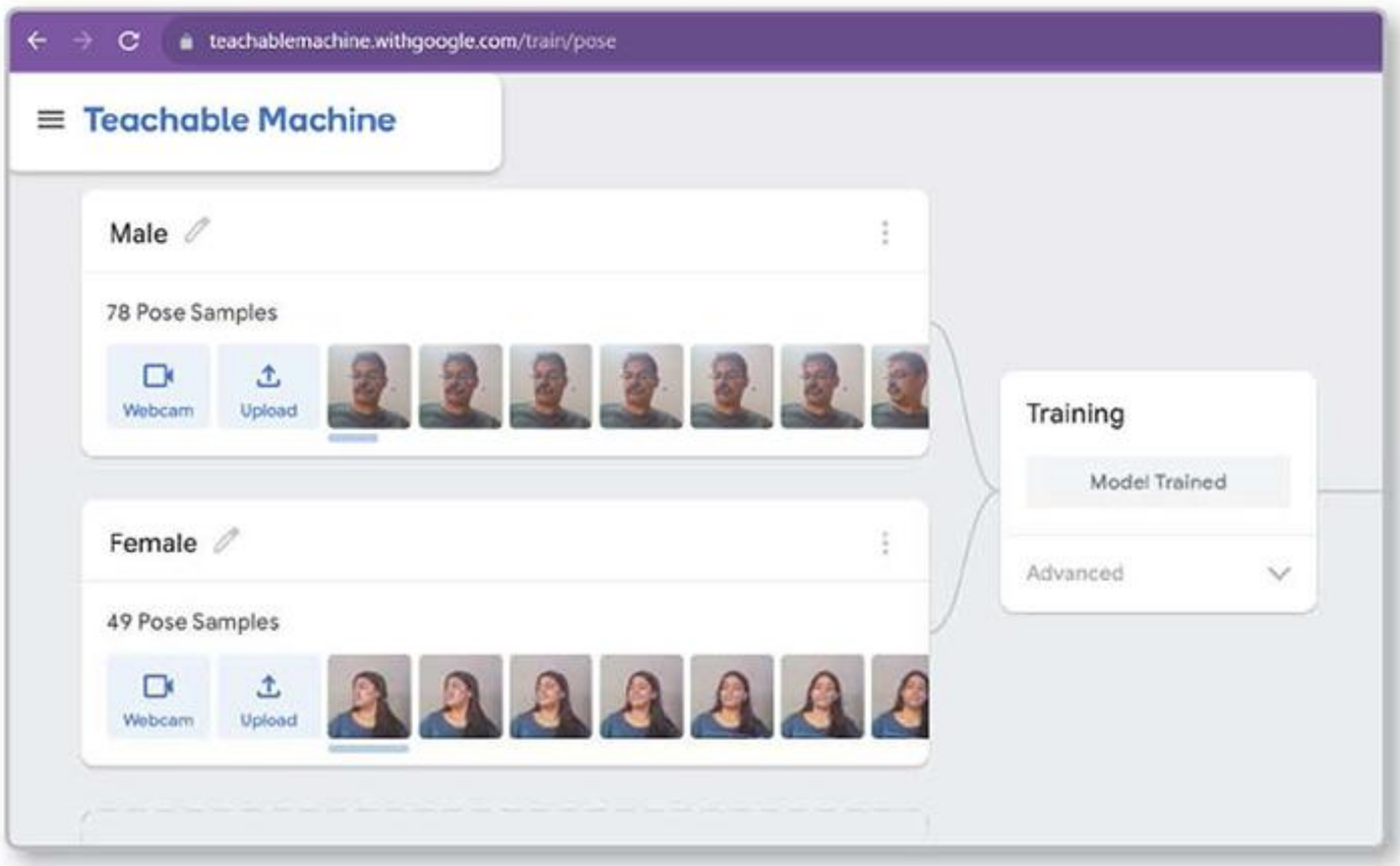
Step 6 Likewise as in Step 5, we do the same with the class 2, which is Female in this case.



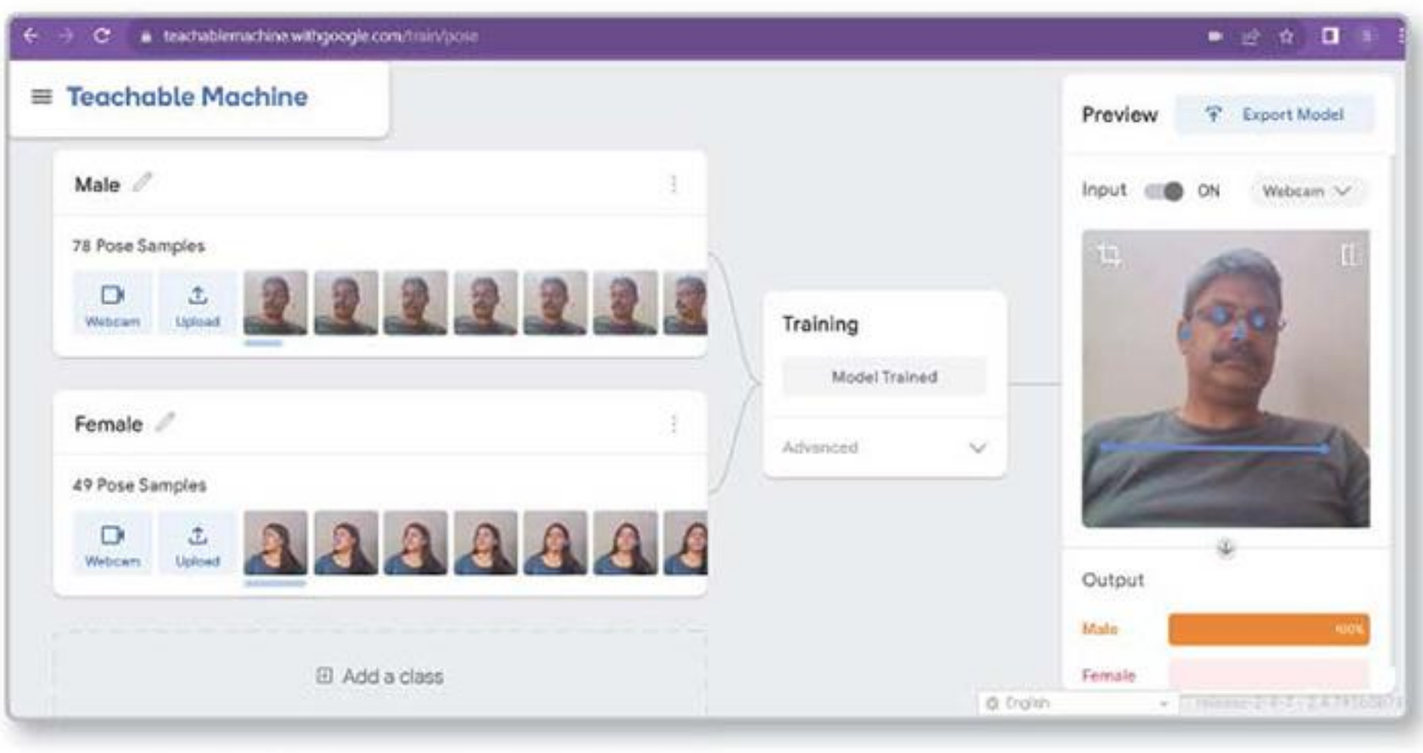
Step 7 Once we have got the sample images of both the class or subject, we click the button "Train Model" in the window with the heading Training. This starts the process of training the model.



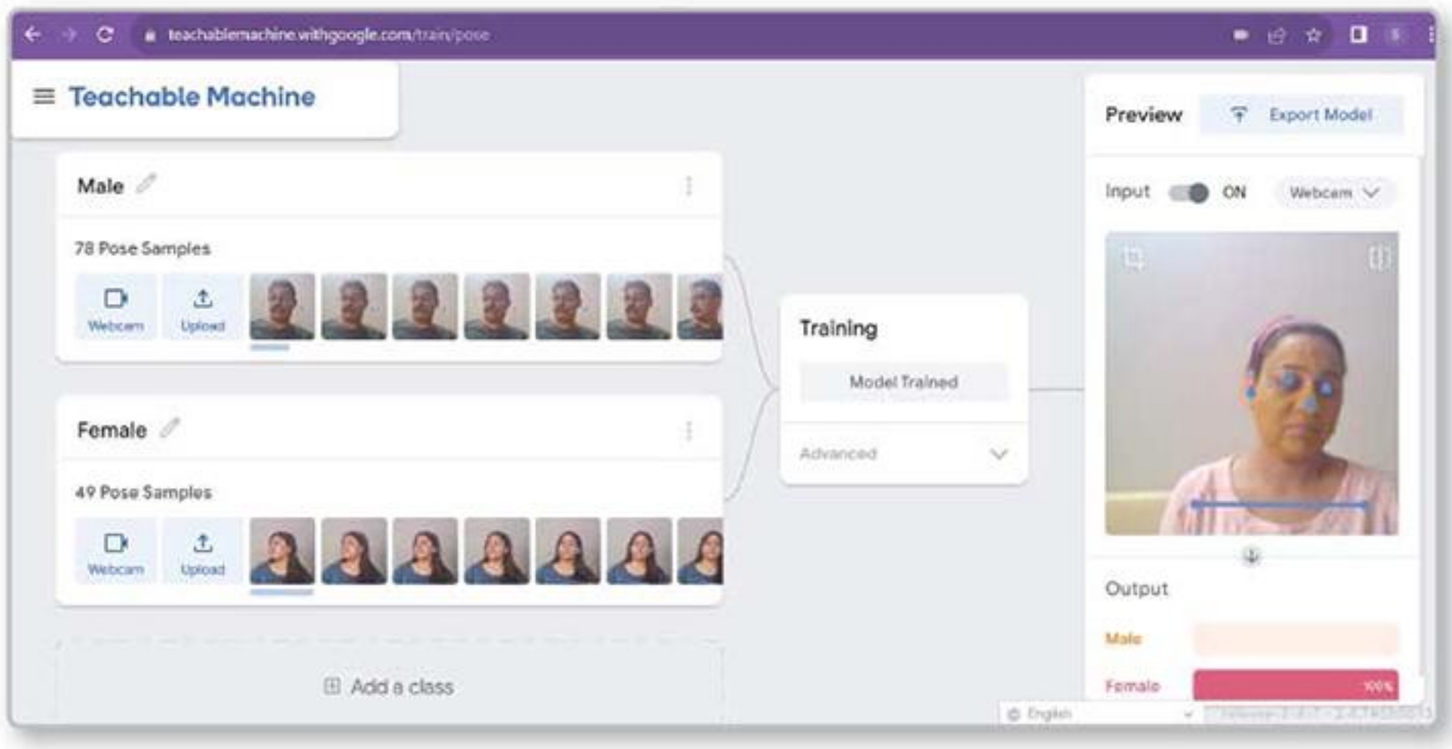
Step 8 Once the model is trained, the message will change to "Model Trained". Now the model is ready for testing.



Step 9 Once we bring any of the subjects in front of the camera in any position, the output of the model would be able to identify what the subject is. It would reflect in percentage as to how much percent it is able to identify the subject in comparison to the images which were used for training the model.

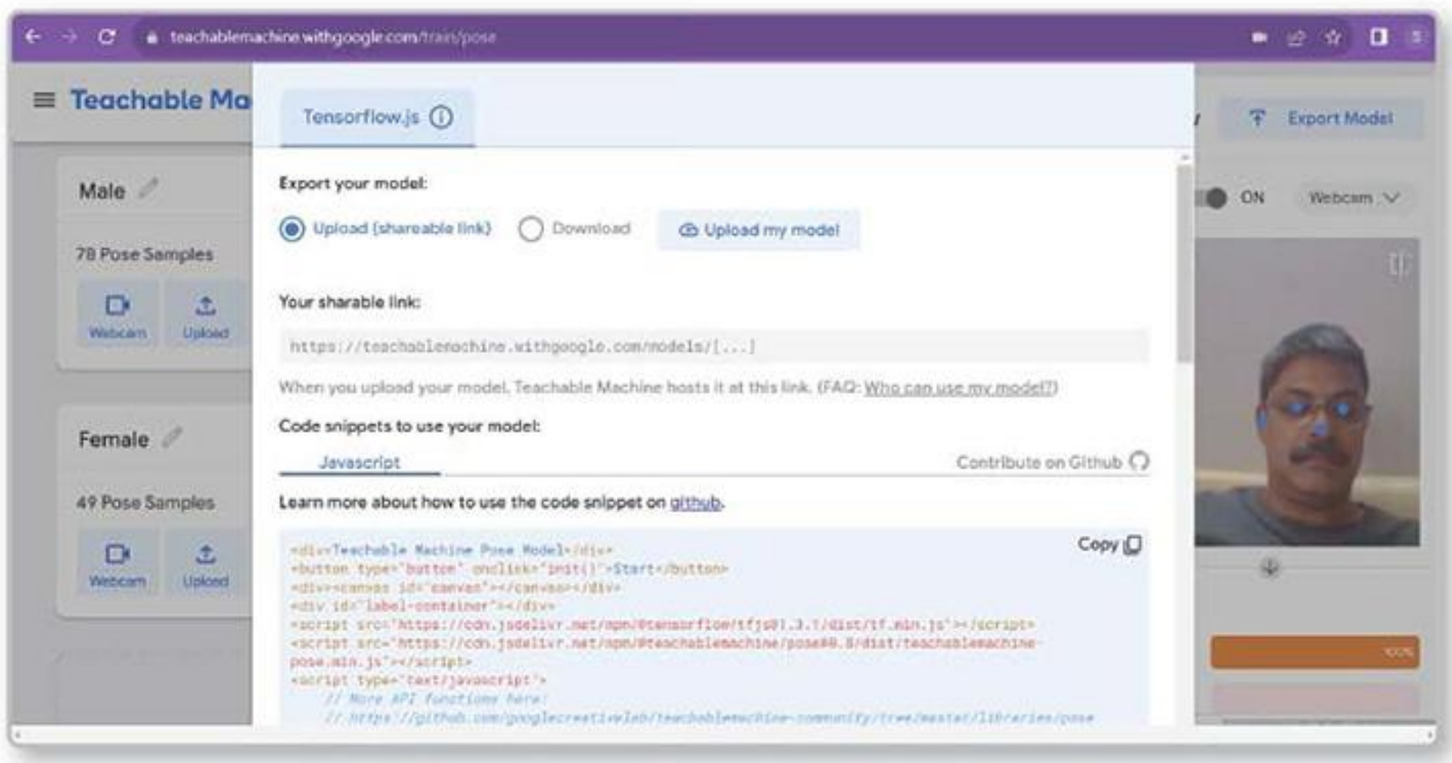


Step 10 We can test the system with the other subjects also, like we did in Step 9.

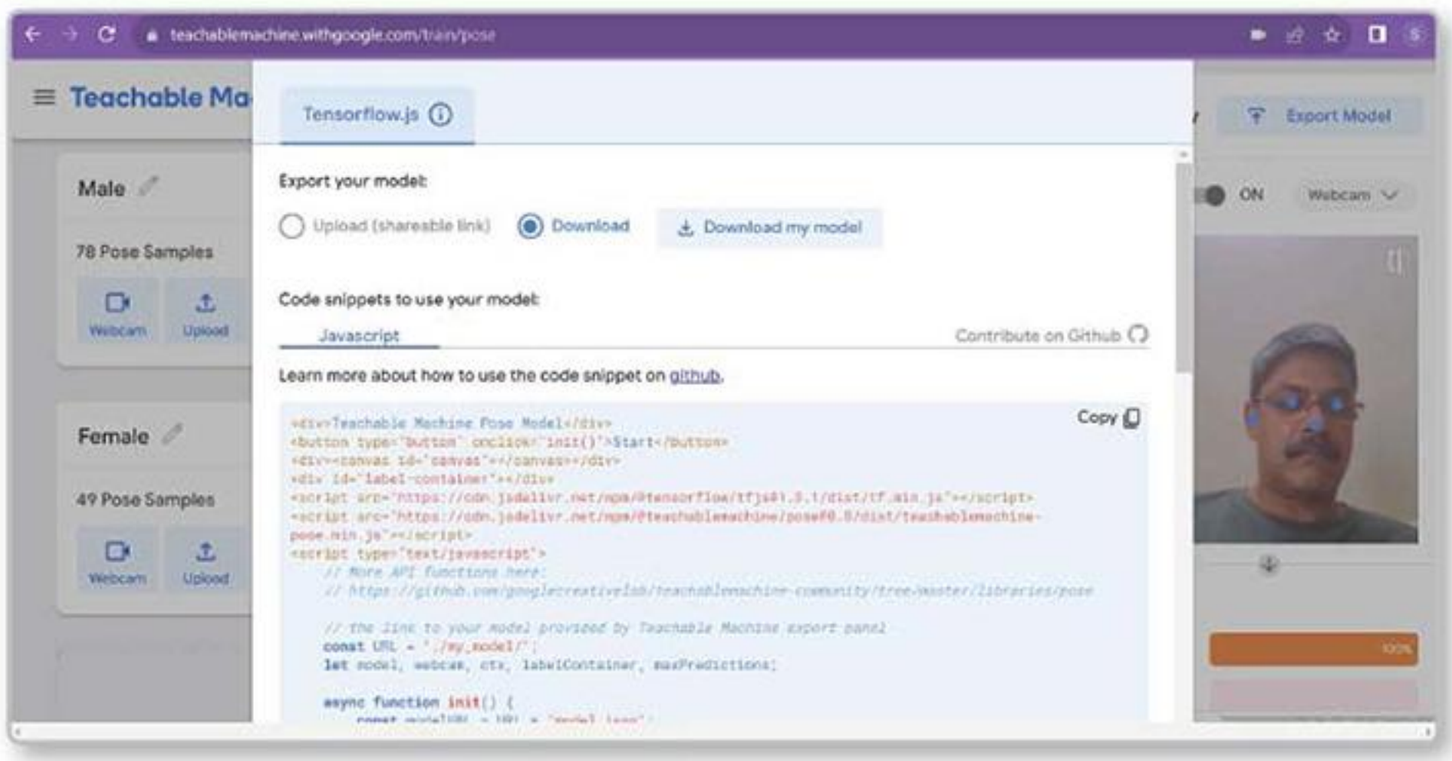


Step 11 The code of the project that we created can be exported by clicking the Export Model button:

Step 12 Once we click on Export Model, it opens up the window which gives you the option to get the shareable link of the code.

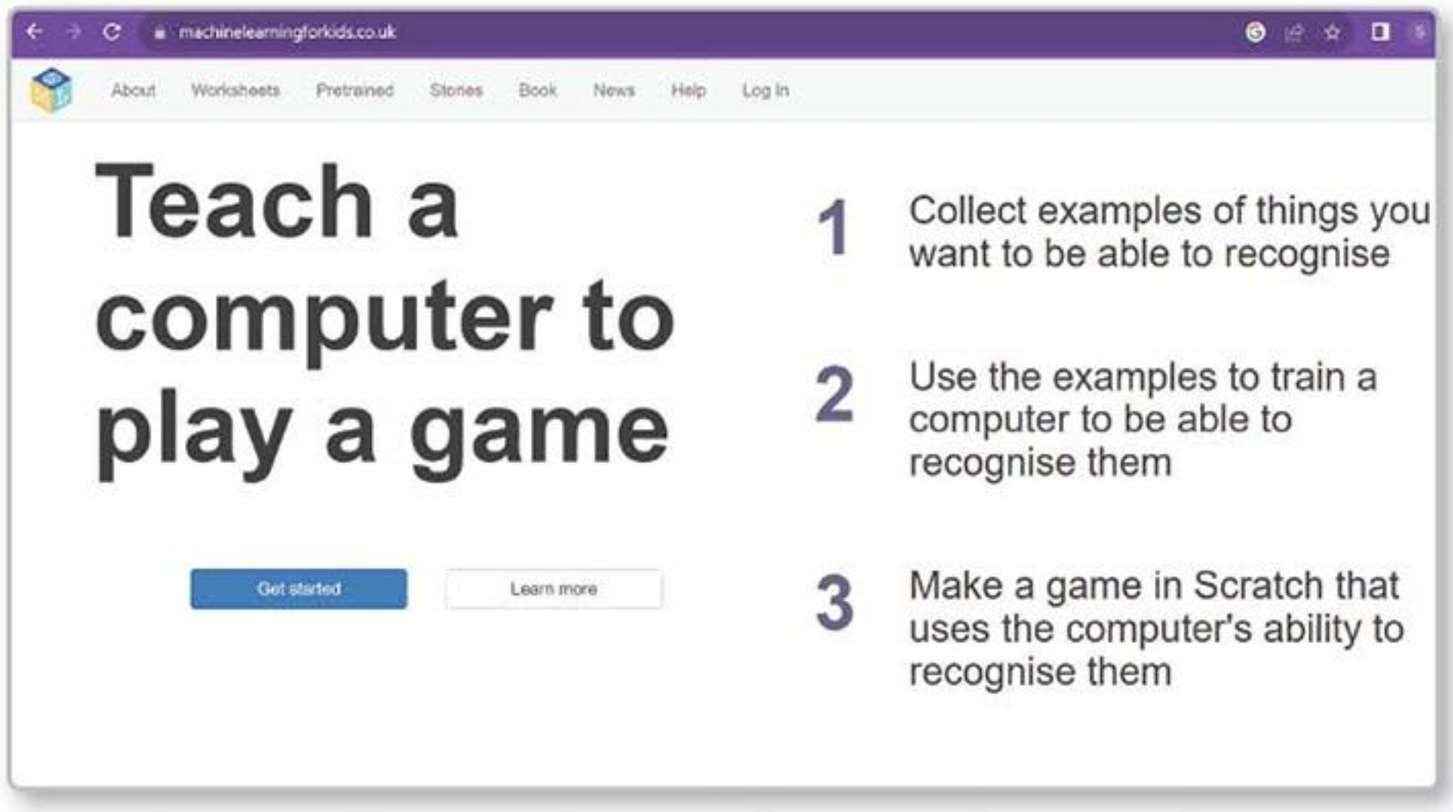


Step 13 The other option would be Download, which would allow you to download the code and Embed it on your website.

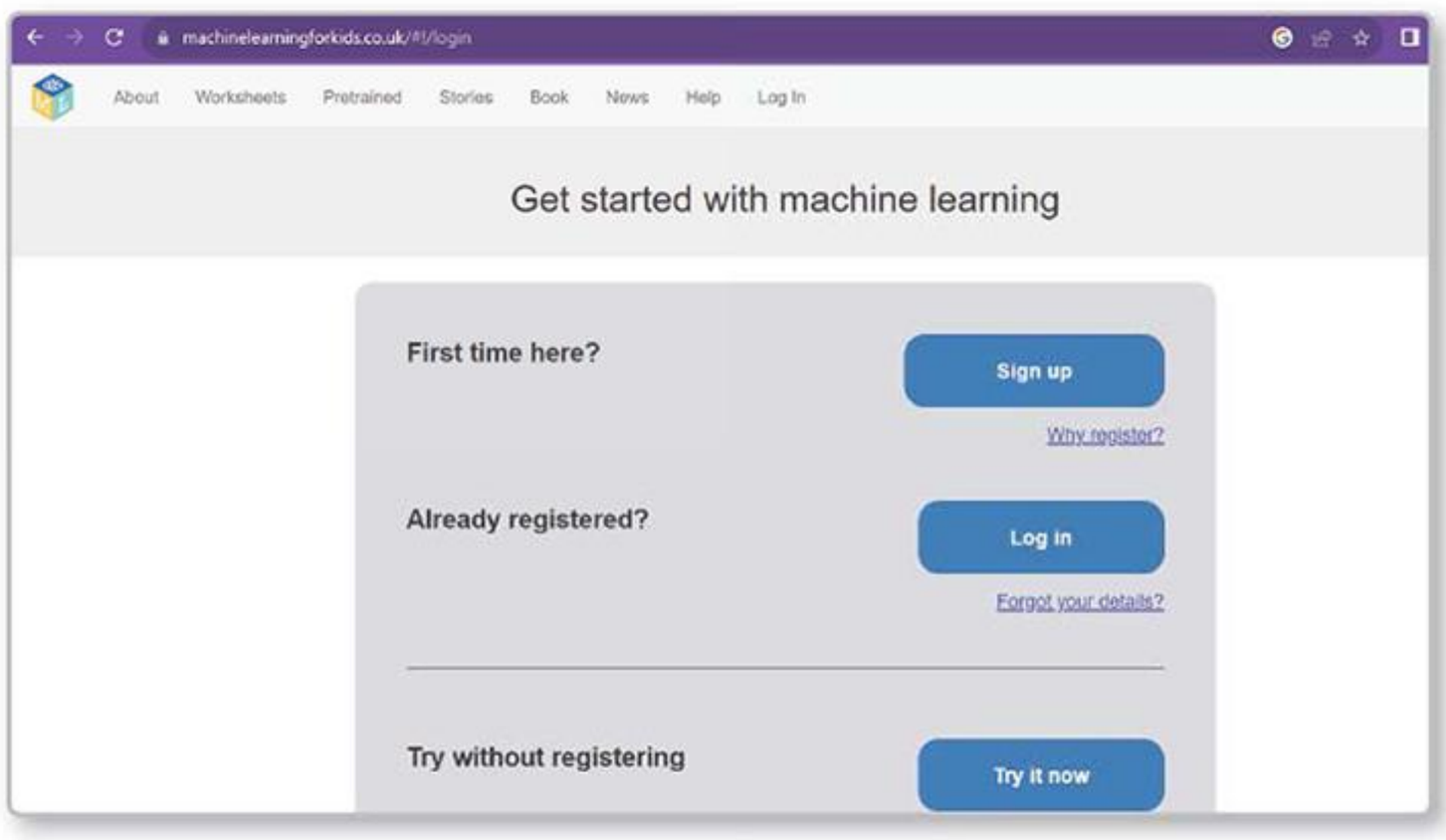


1.3 Using Machine Learning for Kids

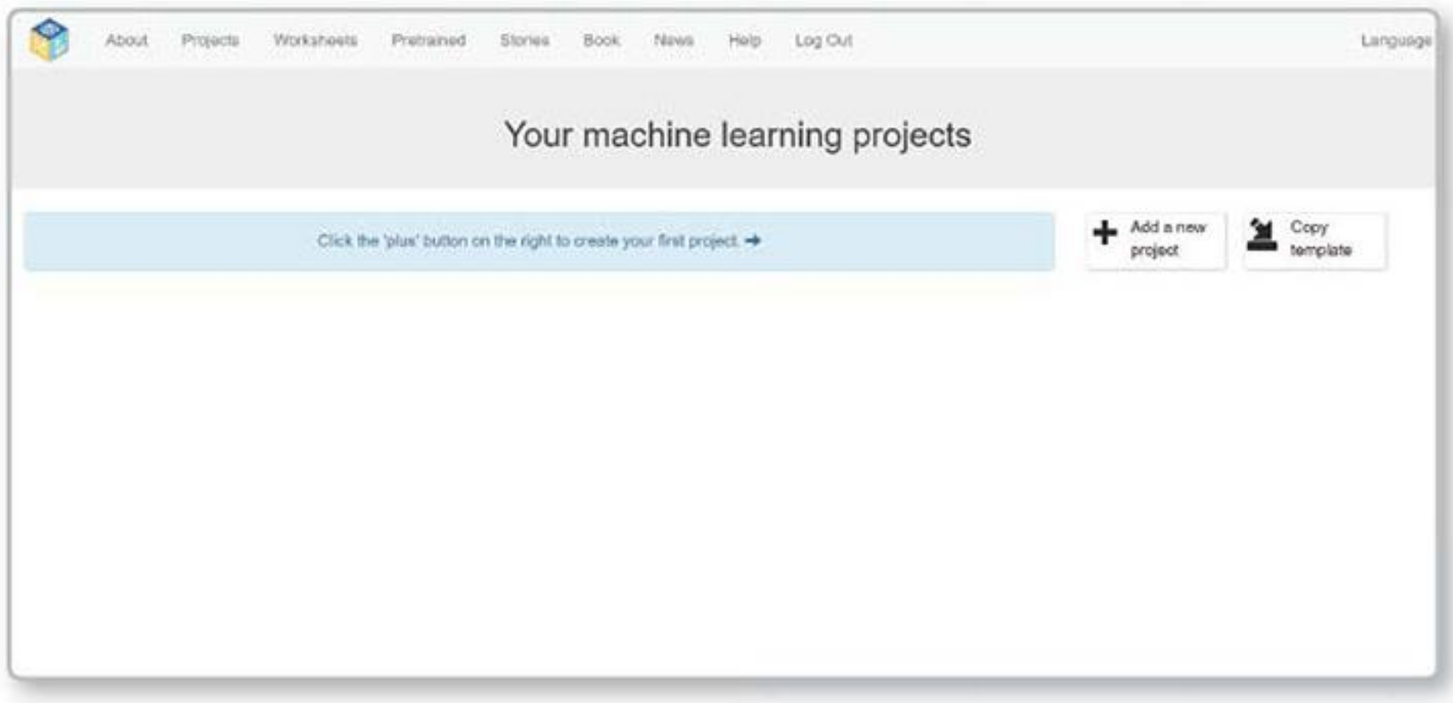
Step 1 Visit https://machinelearningforkids.co.uk/ and click Get Started.



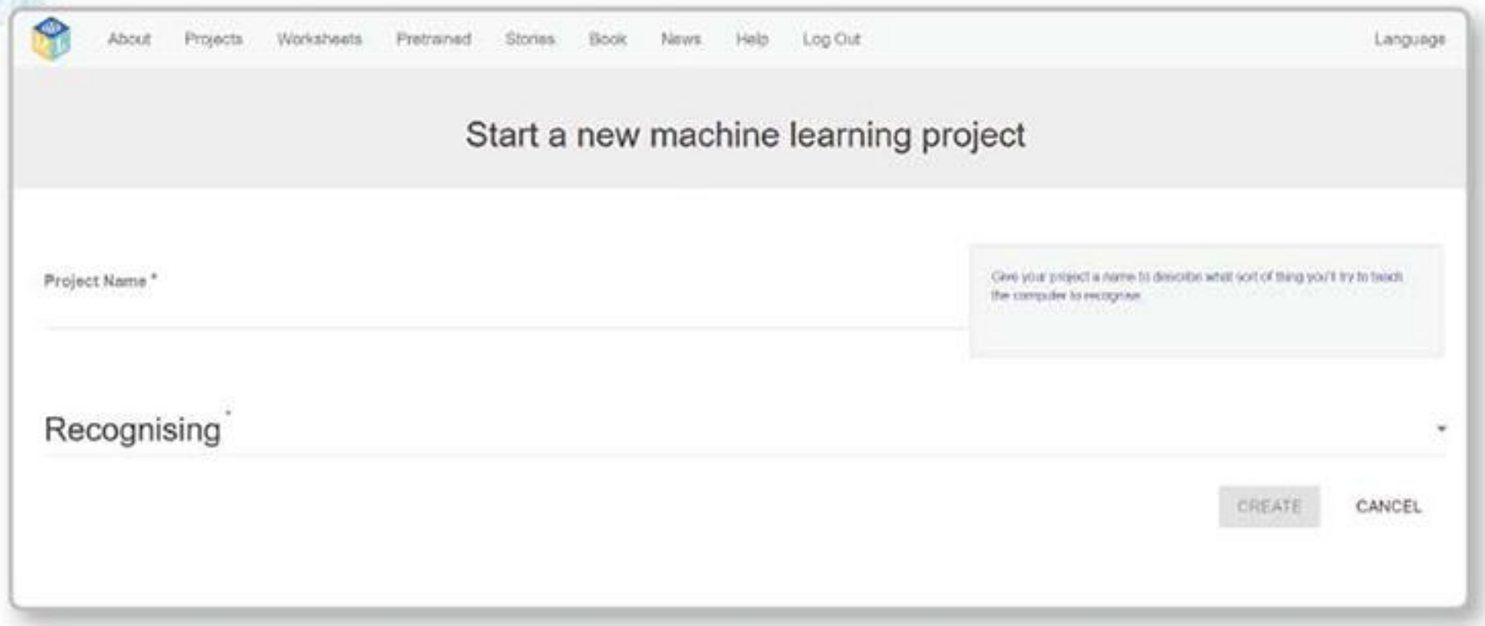
Step 2 Select the Try it now option.

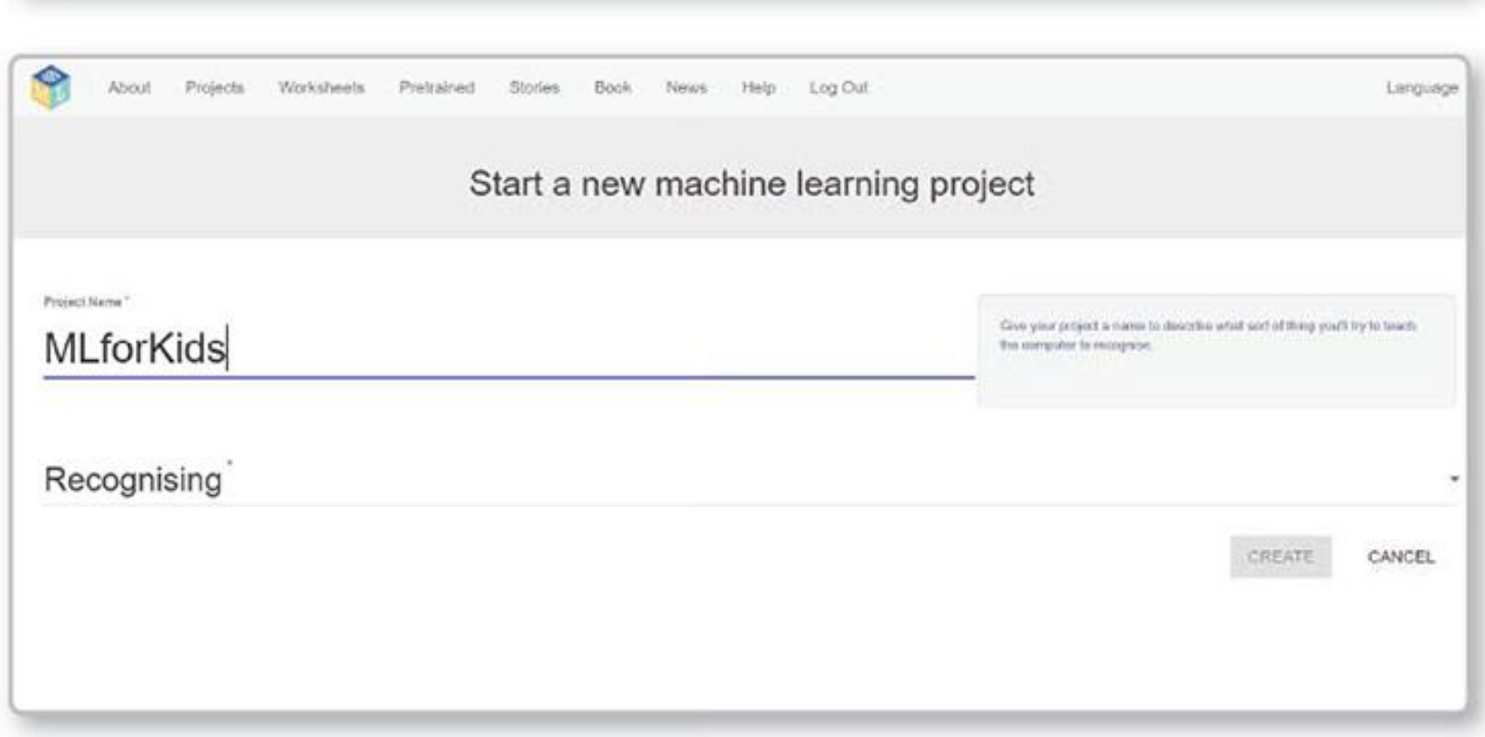


Step 3 The next screen gives you the option to add a new project by clicking the Add a new project button

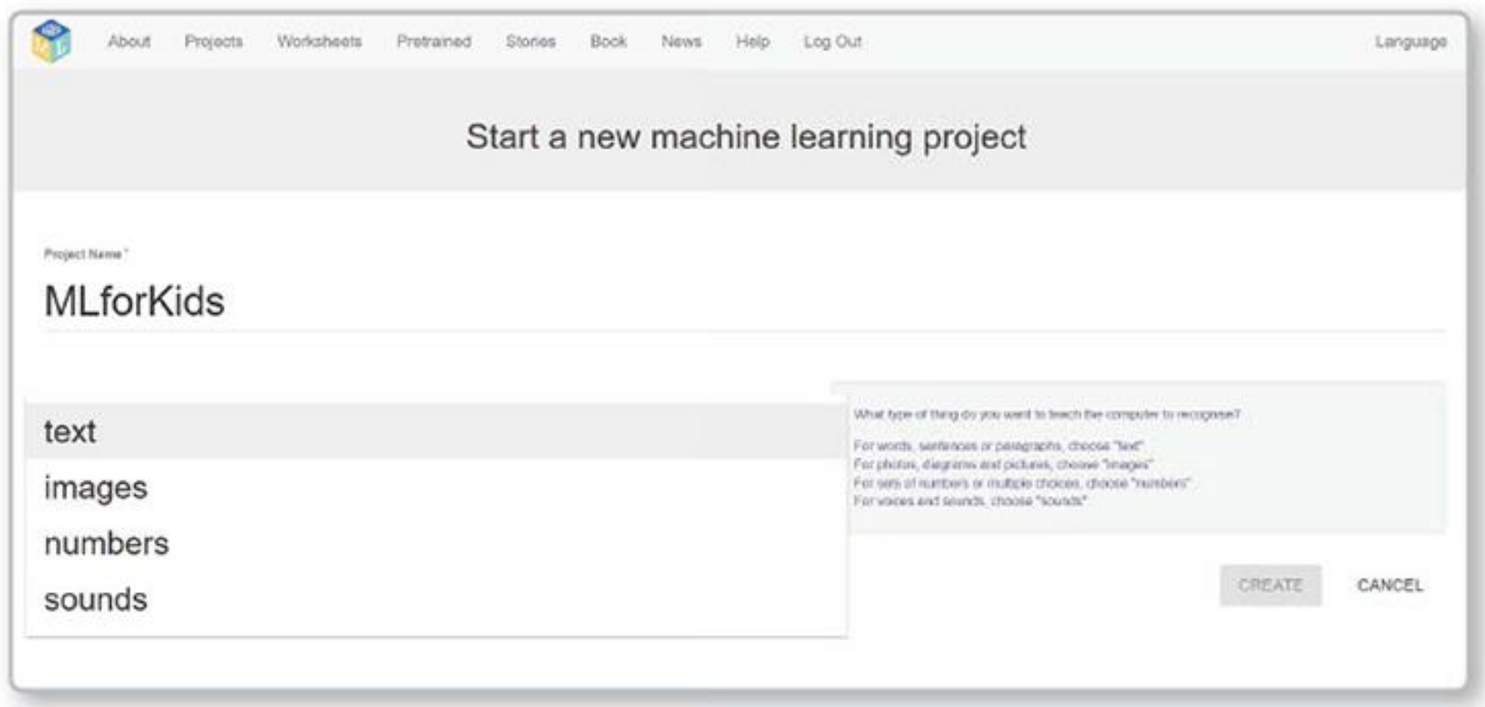


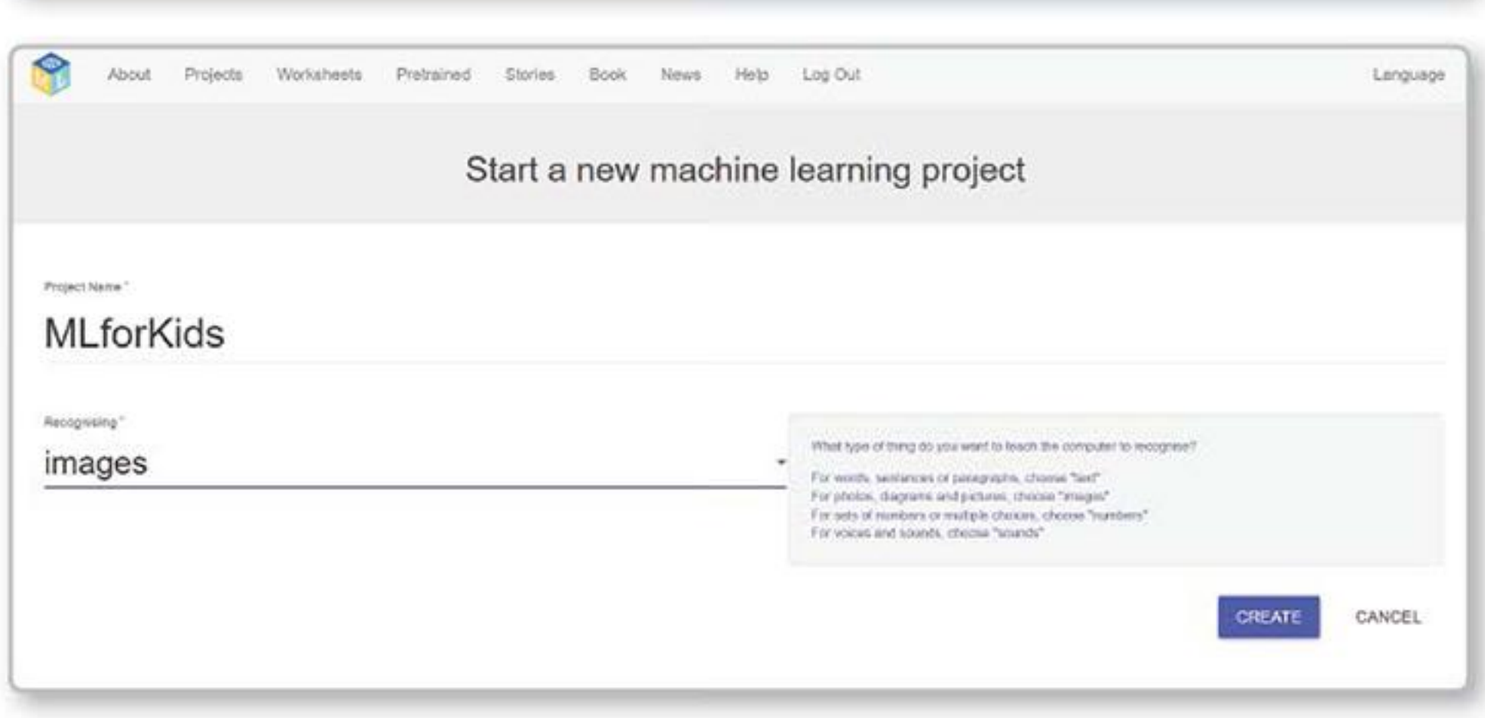
Step 4 The next screen gives you the option to give the name to your project. Click on the line where it says "Project Name", and give a name.





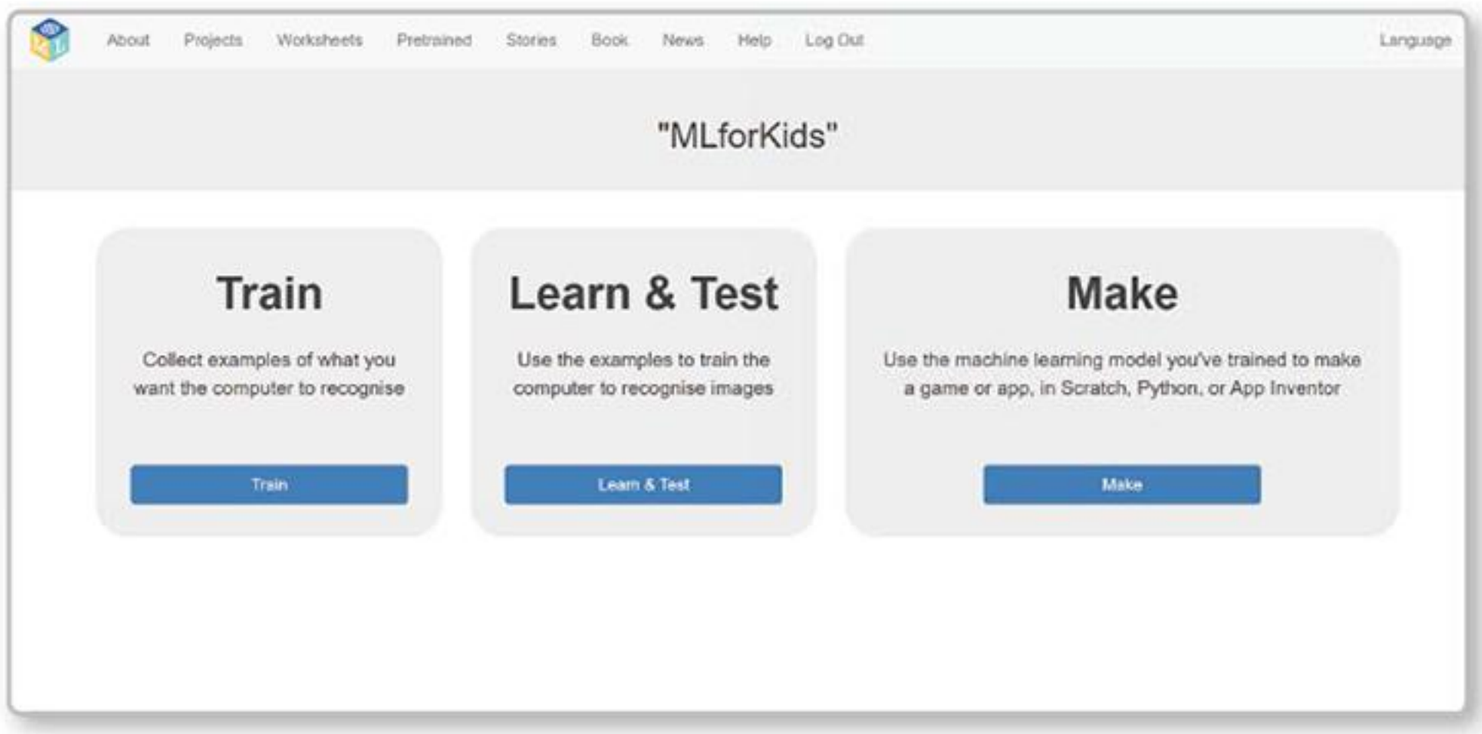
Step 5 Just below the project name, the type of project that we are doing, the could be done with test, images, numbers and sounds. So we select images for today. You can try the other options also, later.



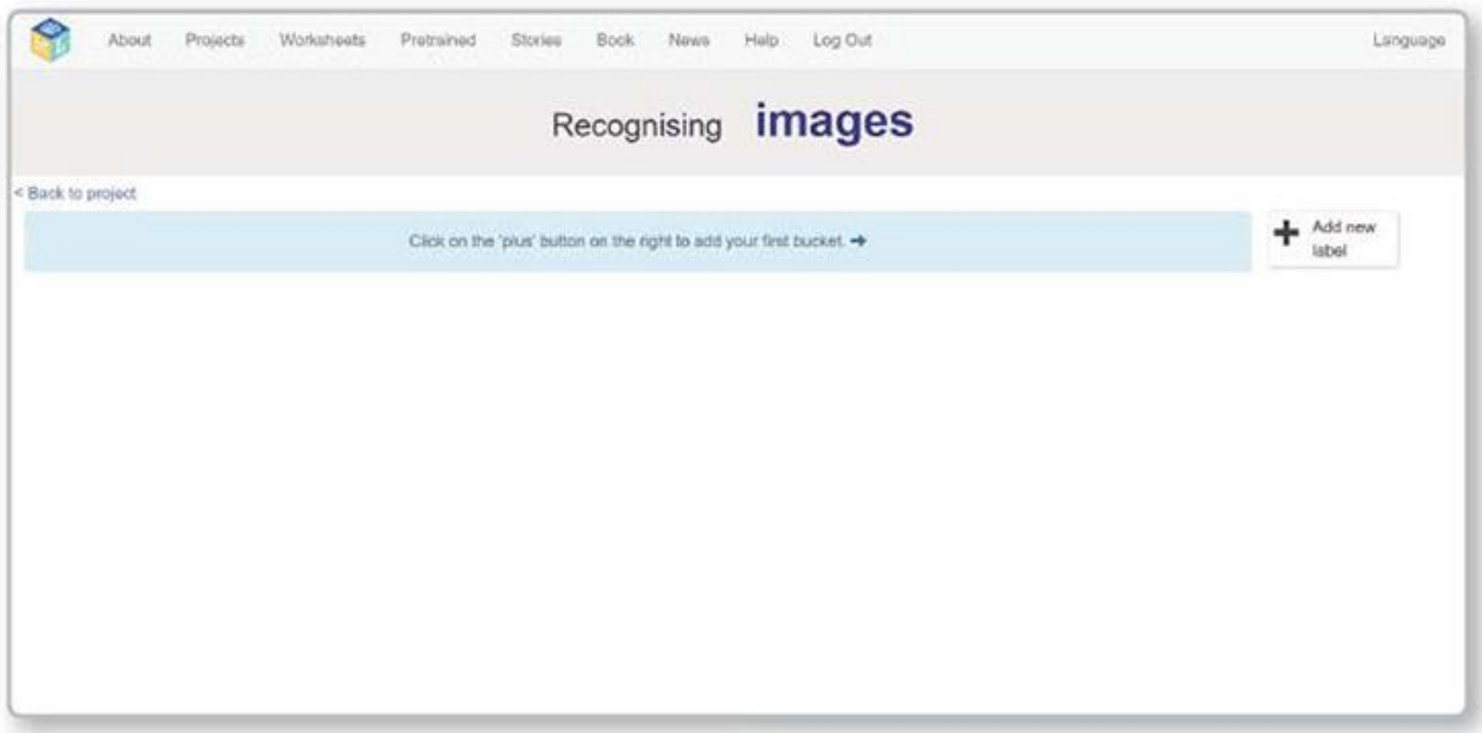


Step 6 Once we click CREATE, our project framework is ready for data input and training.

Step 7 Now when we click on our project name, it gives us three options of Train, Learn & Test and Make. We, click on the Train button.

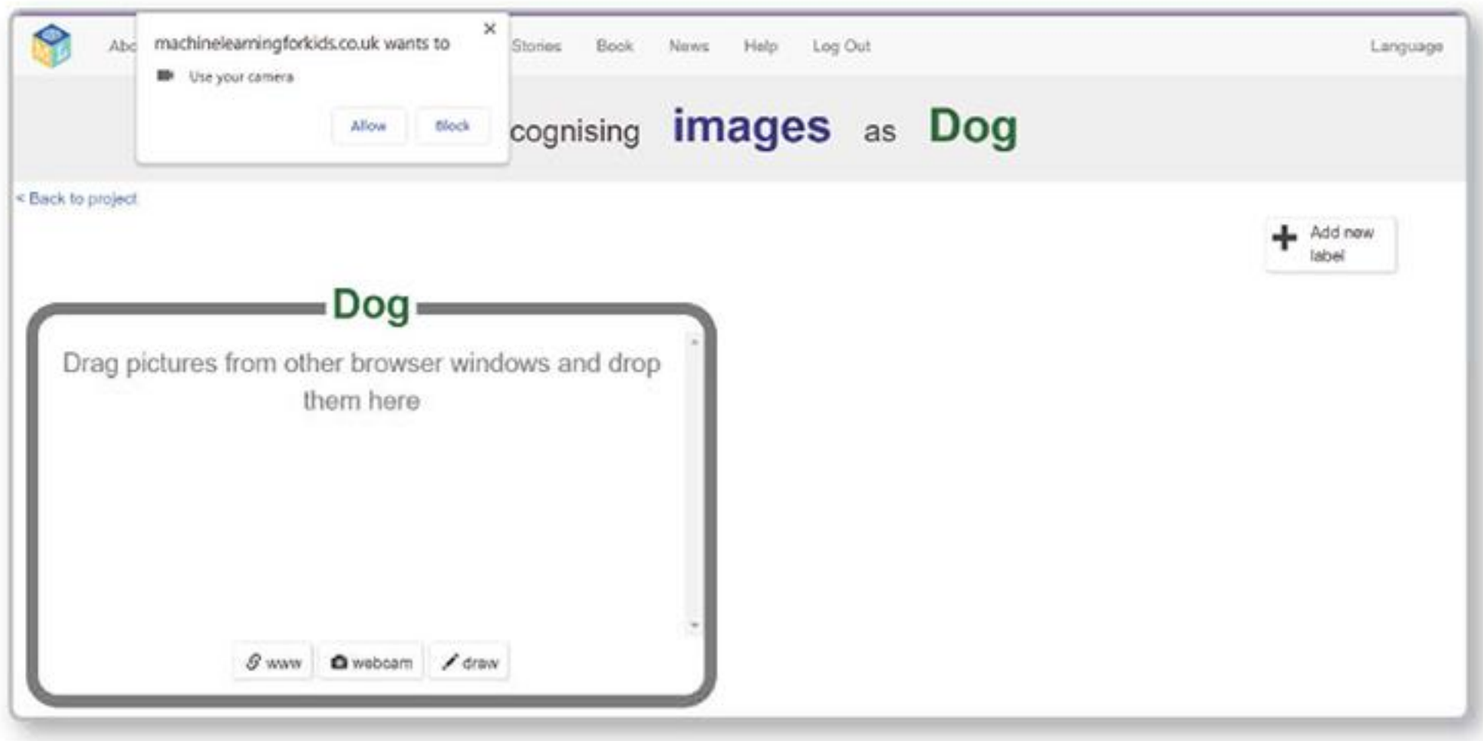


Step 8 Under Train it gives us the option to add images of different objects/items that we want to train the algorithm of. We Click on "Add new label".

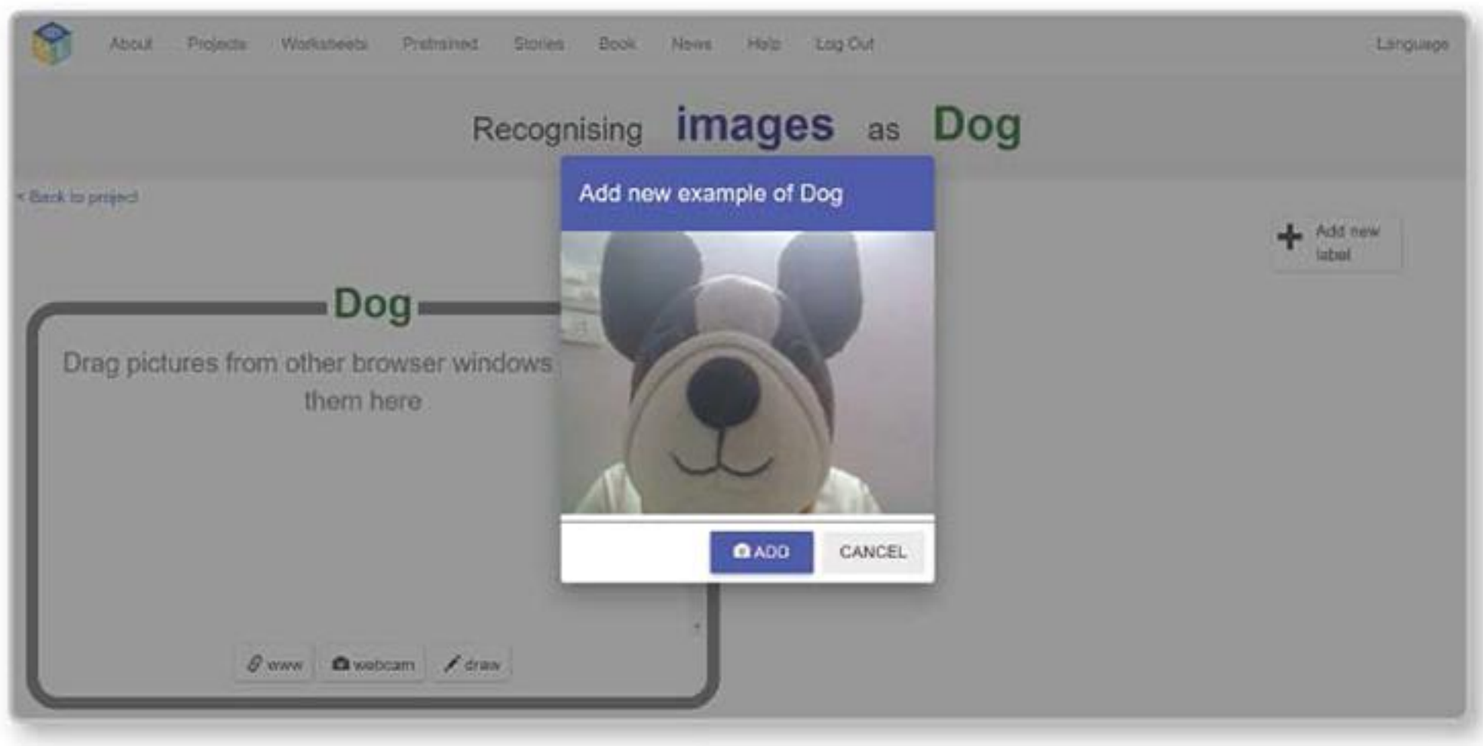


Step 9 On Add new label screen we give the name of the object that we want to add pictures of. In our case today we are using Dog as one of the subjects of comparison. You can choose your own object.

Step 10 Once we have put the object as Dog, we get a rectangle box like image, which gives us three options, of providing the link to the images, using a webcam to click an image, or draw the image. We selected the webcam option today. It asks for permission to access Camera of your system to which we Allow, but in your case please take permission from your parents/ guardians.

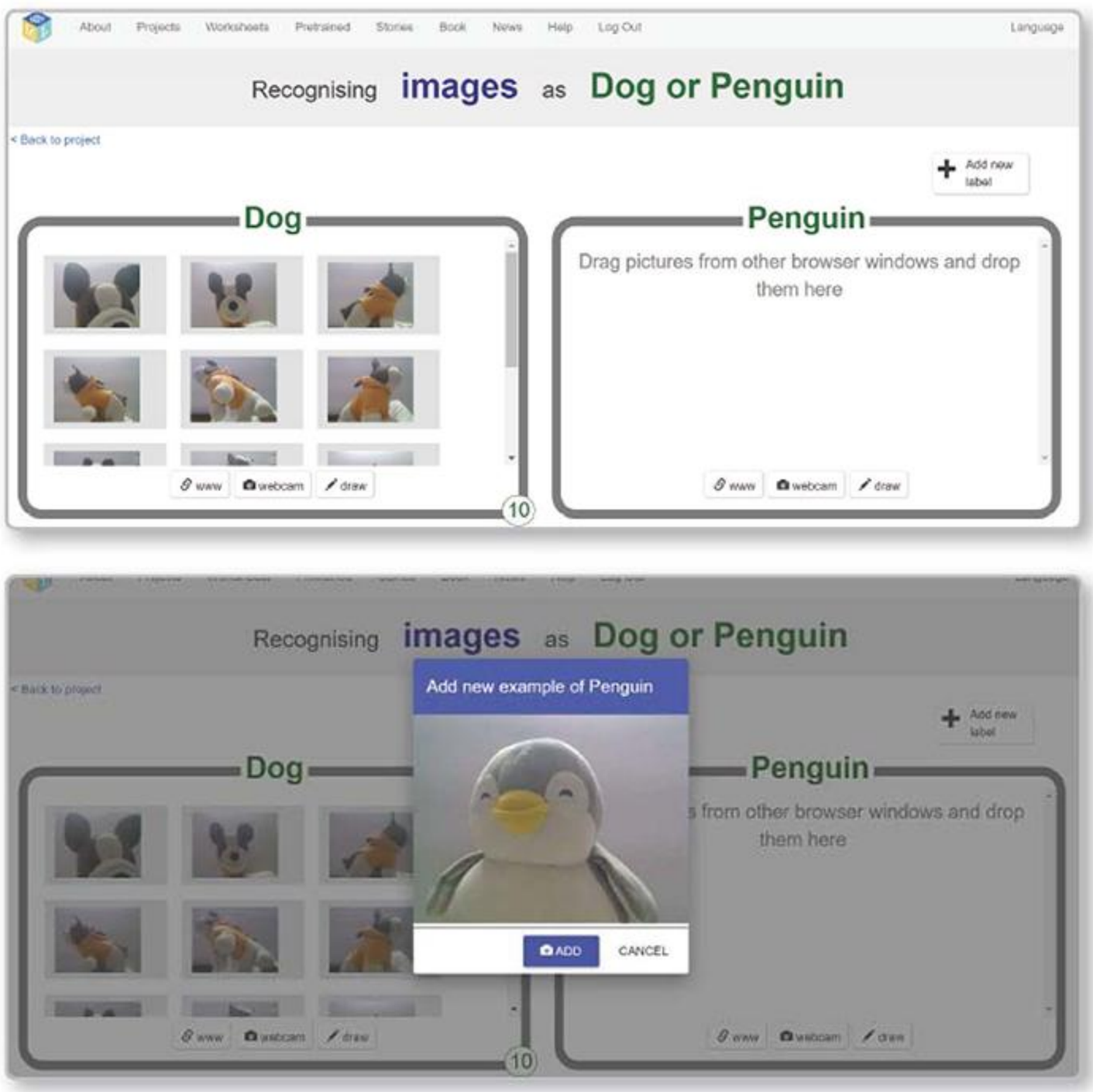


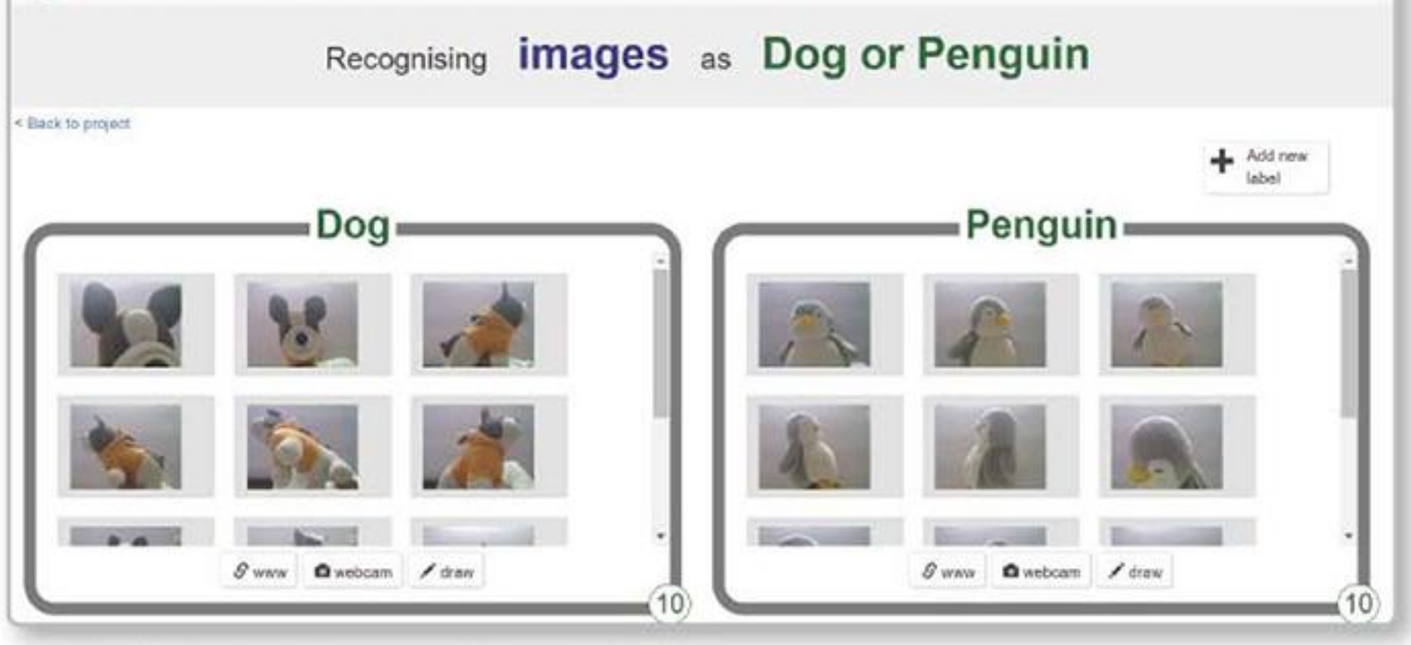
Step 11 After giving permission, it allows us to click image of the object.



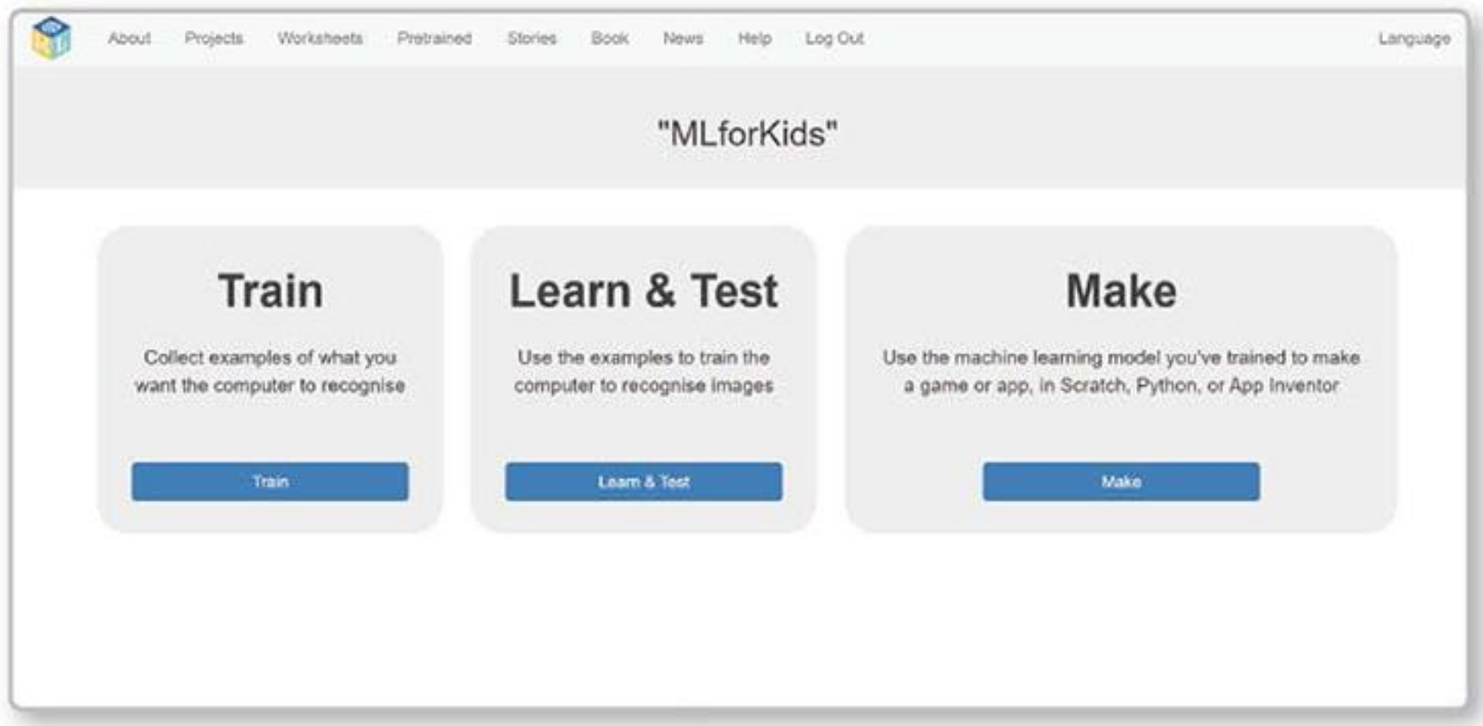
Step 12 We add images of the object from different angles.

Step 13 We repeat the steps 8, 9, 10, 11, 12 to add our other object images.

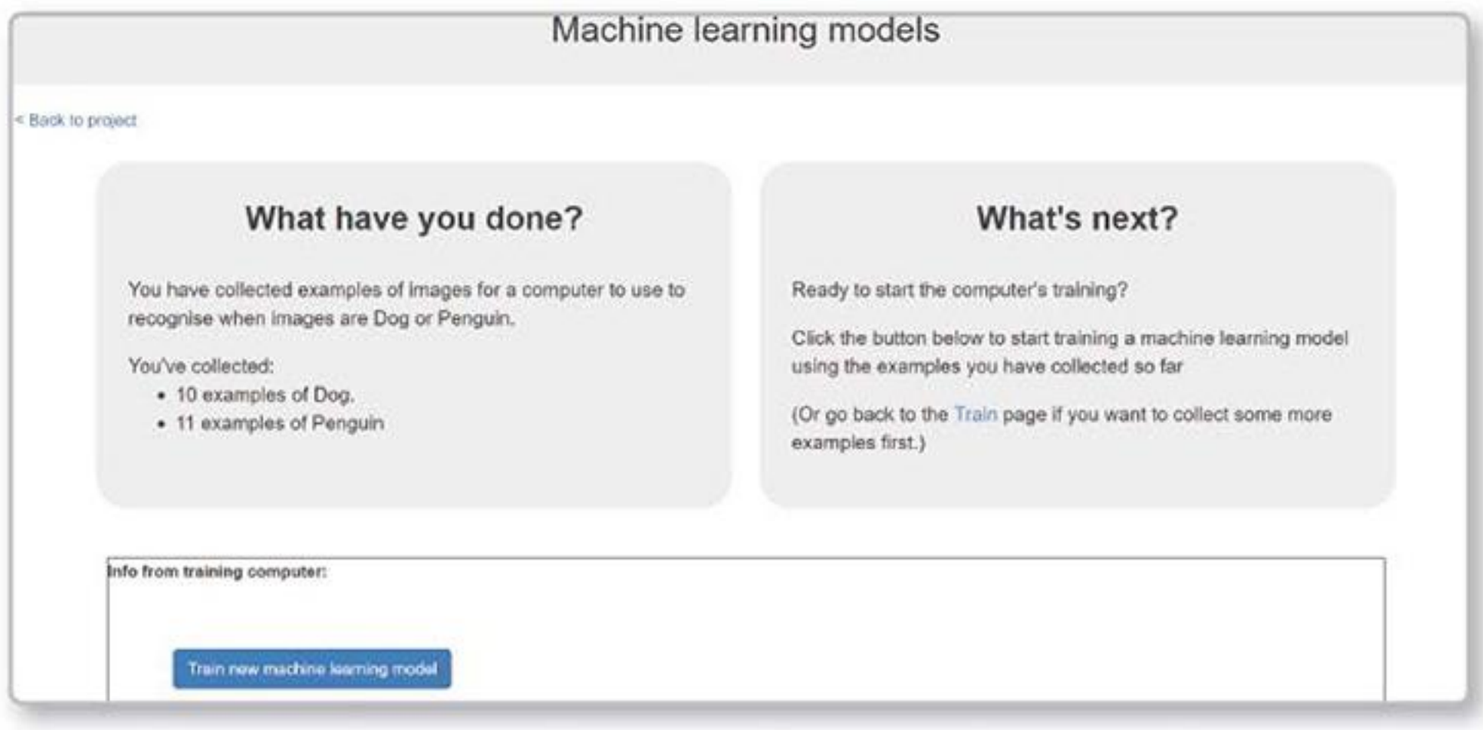




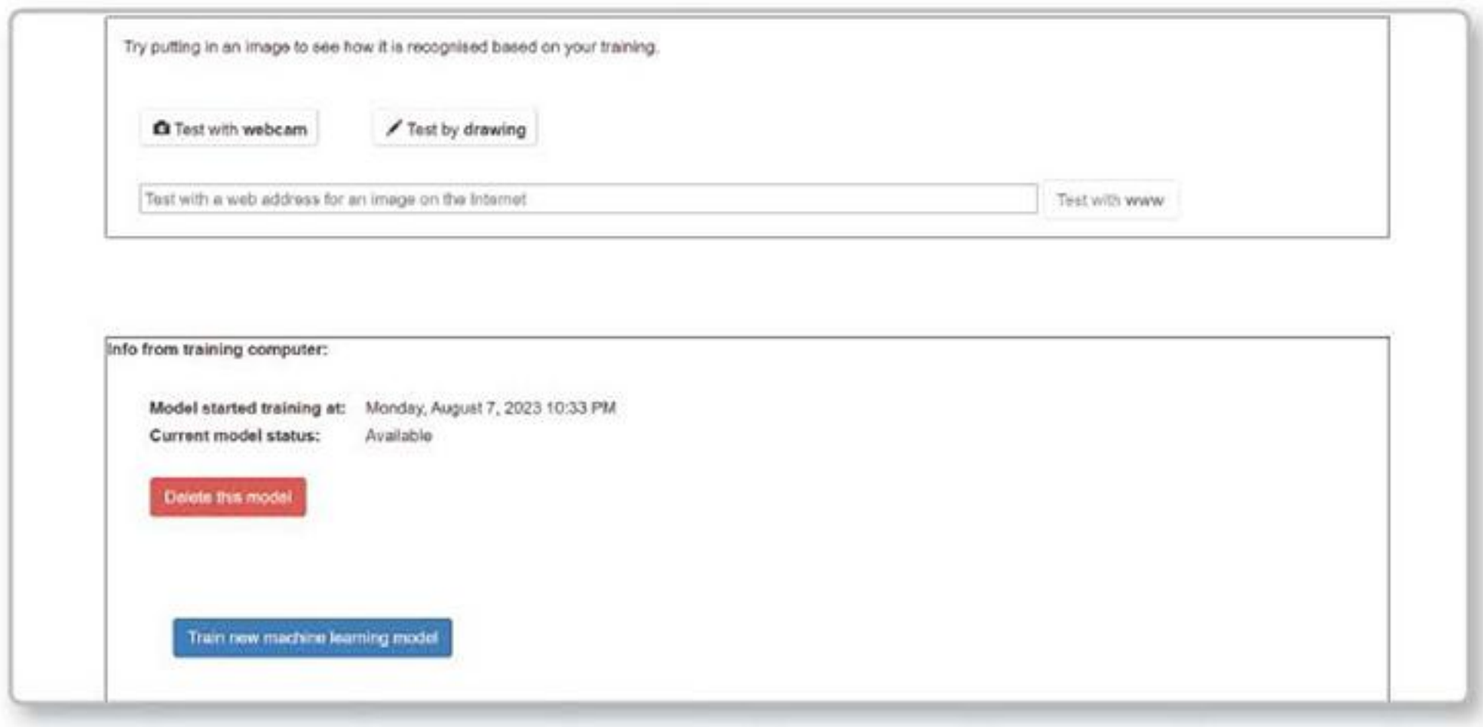
Step 14 We can keep adding more subjects. For today we would stick to these two subjects. Once added, we click "Back to project". It takes us back to the three options. Now we click "Learn & Test"



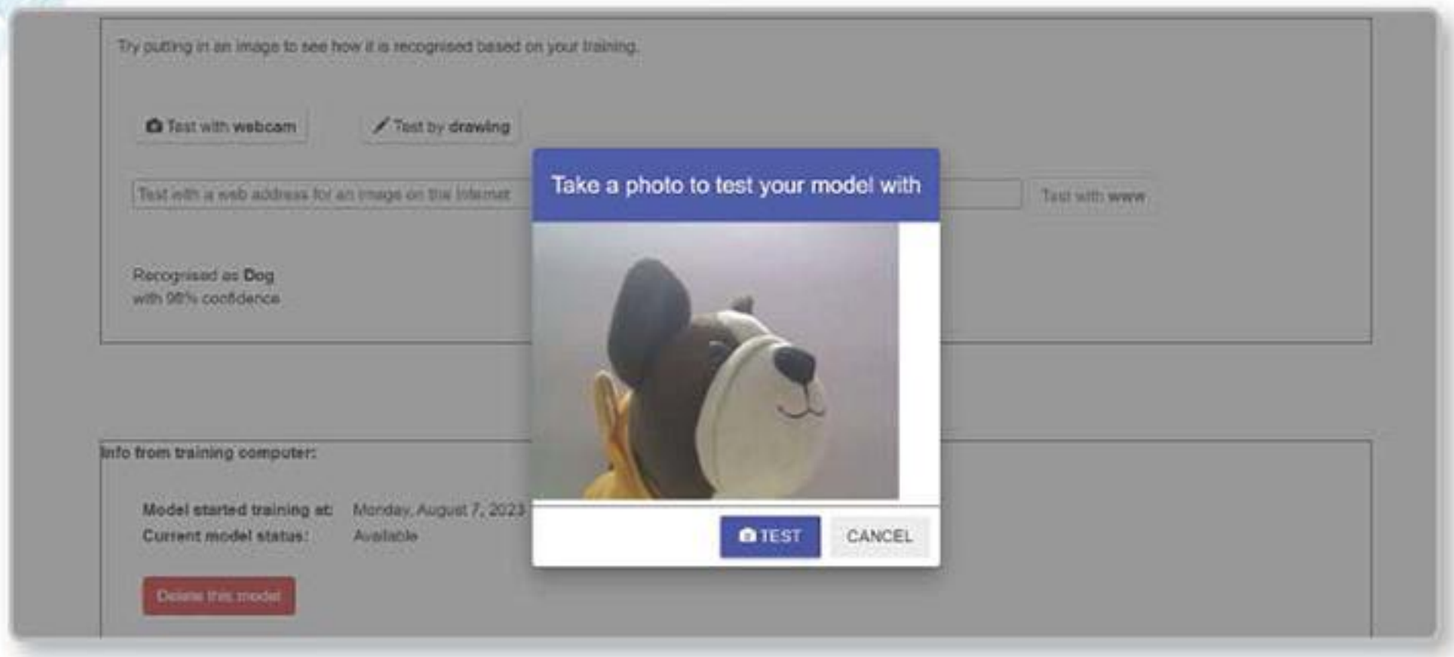
Step 15 Here we click "Train new machine learning model".



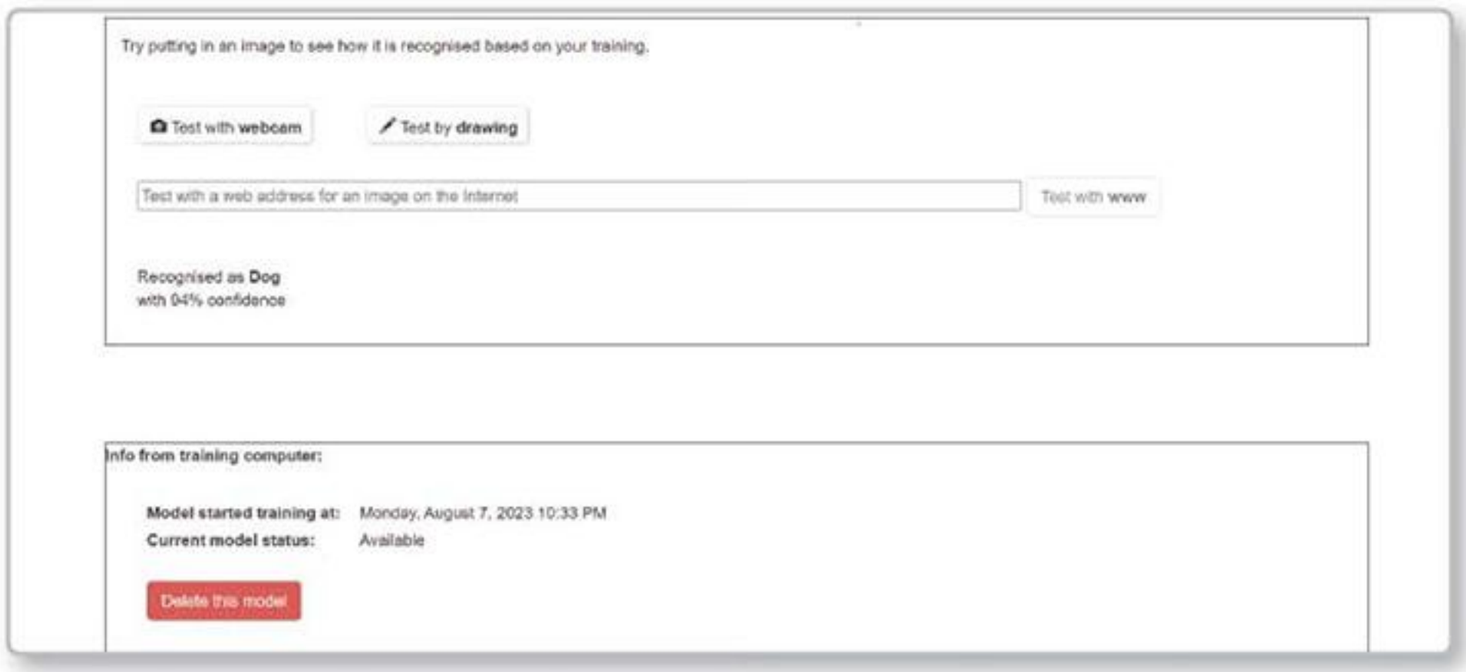
Step 16 It processes the objects and the algorithm is ready for testing.



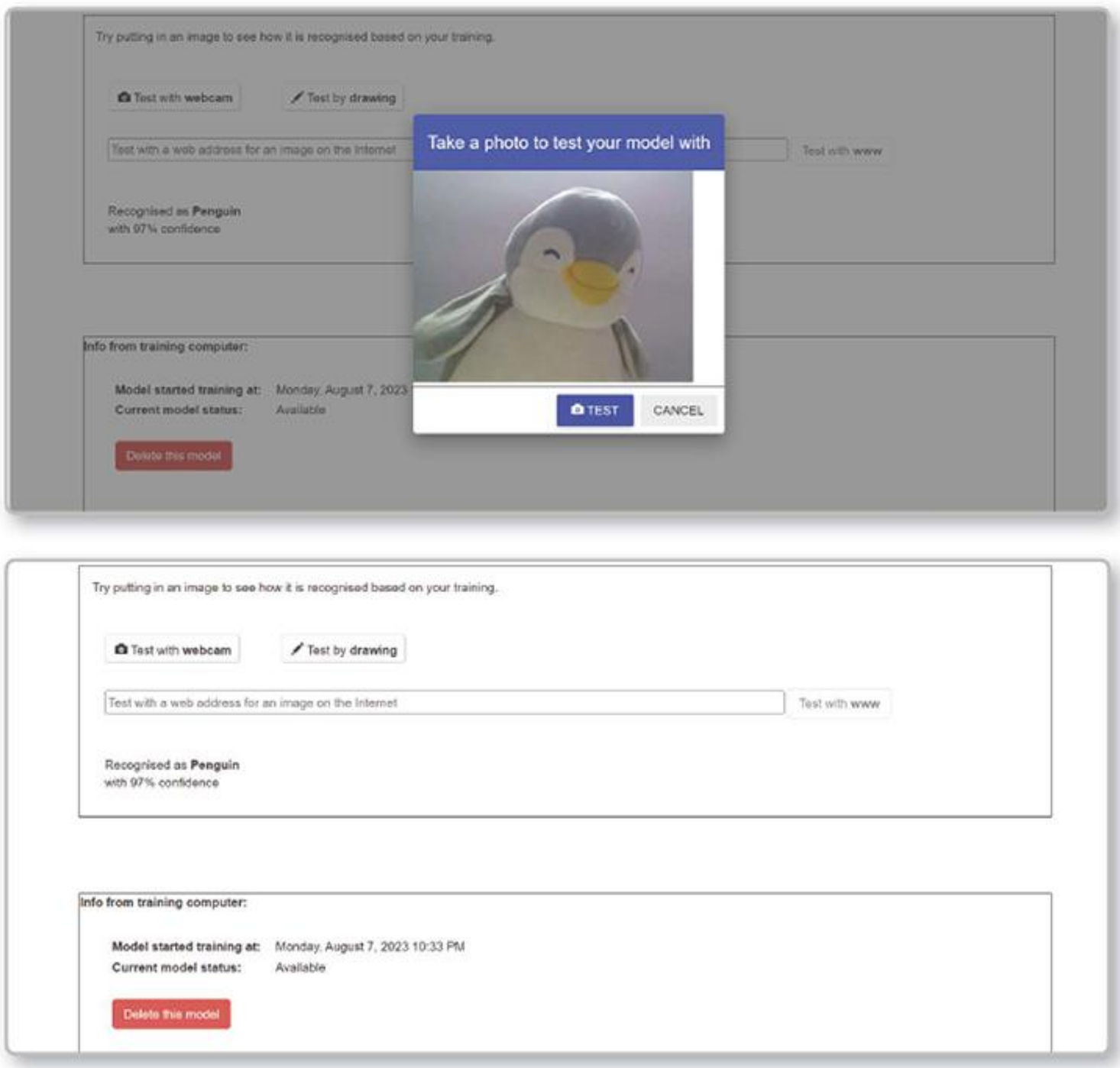
Step 17 Now whenever we click on "Test with webcam", it opens a window and we can place the image in front of the webcam and click "TEST".



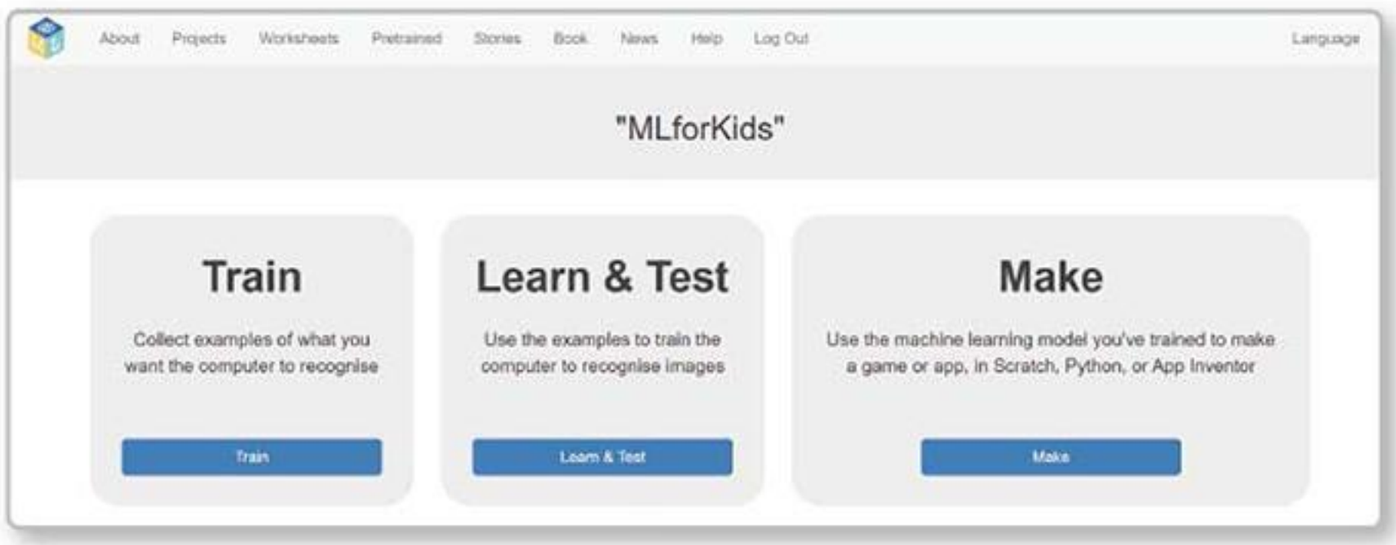
Step 18 Once we click "TEST", it gives us result as to what it has recognised the image with and with how much confidence from the two objects we have trained the machine on.



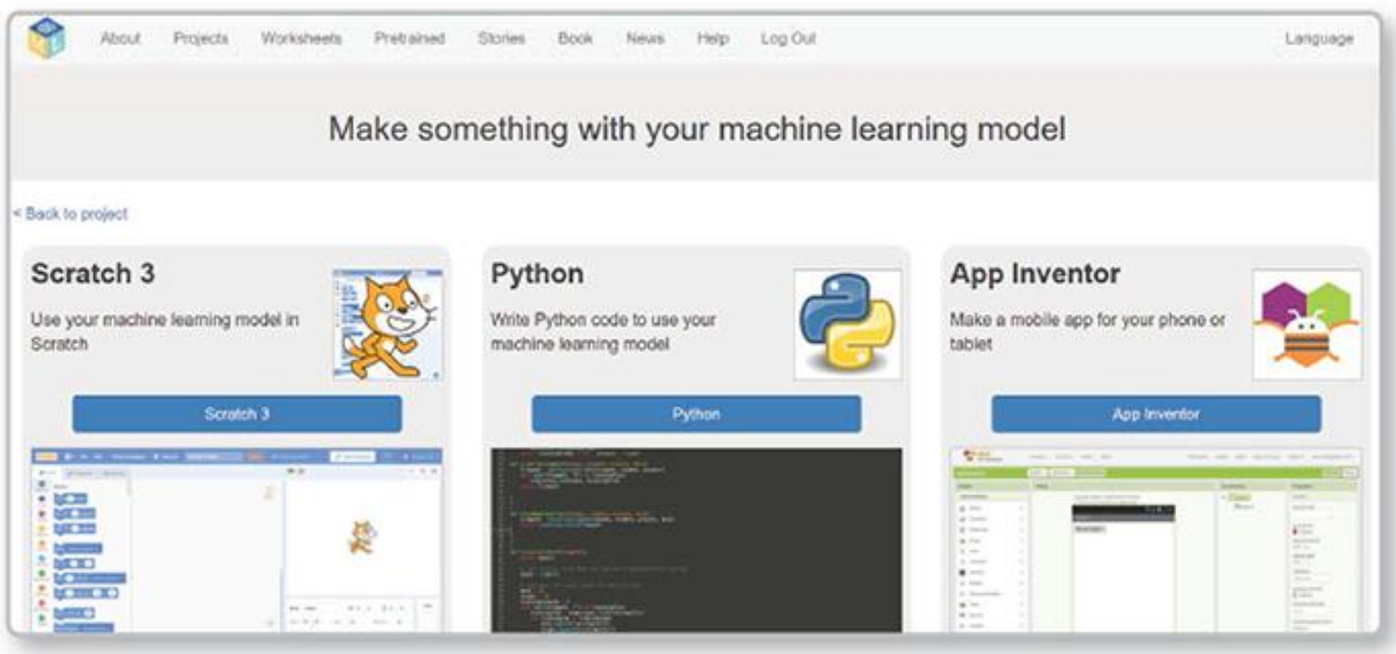
Step 19 You can experiment this with other objects also.



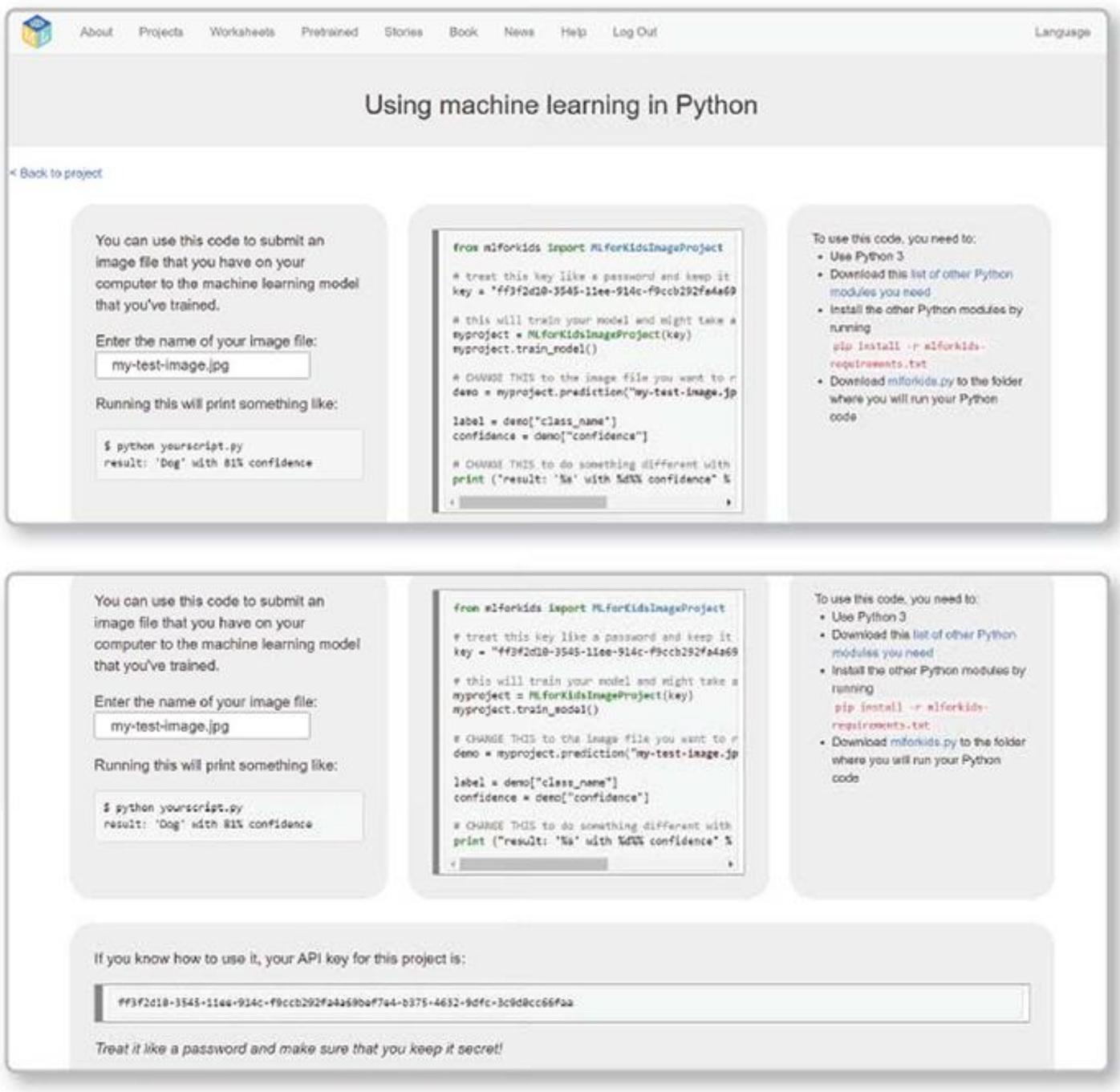
Step 20 We can again go back by clicking on “Back to project”, and we get the ree options again. This time we click “Make”.

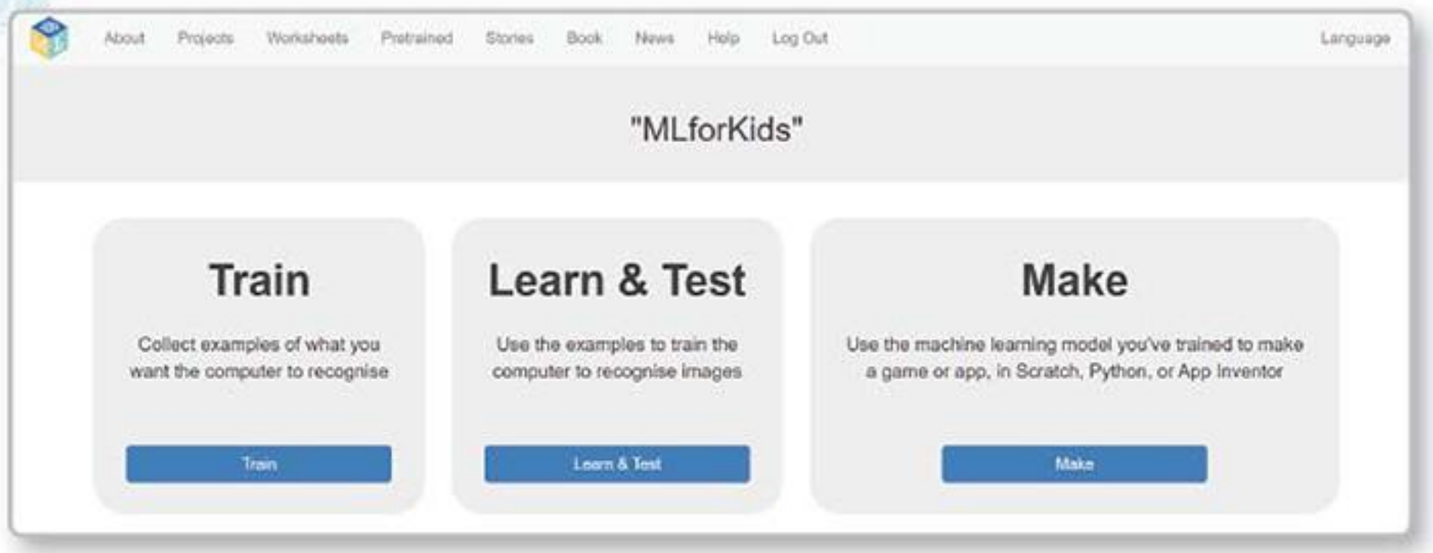


Step 21 Under “Make” it gives us the ability to take this project to Scratch, Python and App Inventor apps. Please see the images of the options as under.



For Python




About
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Pretrained
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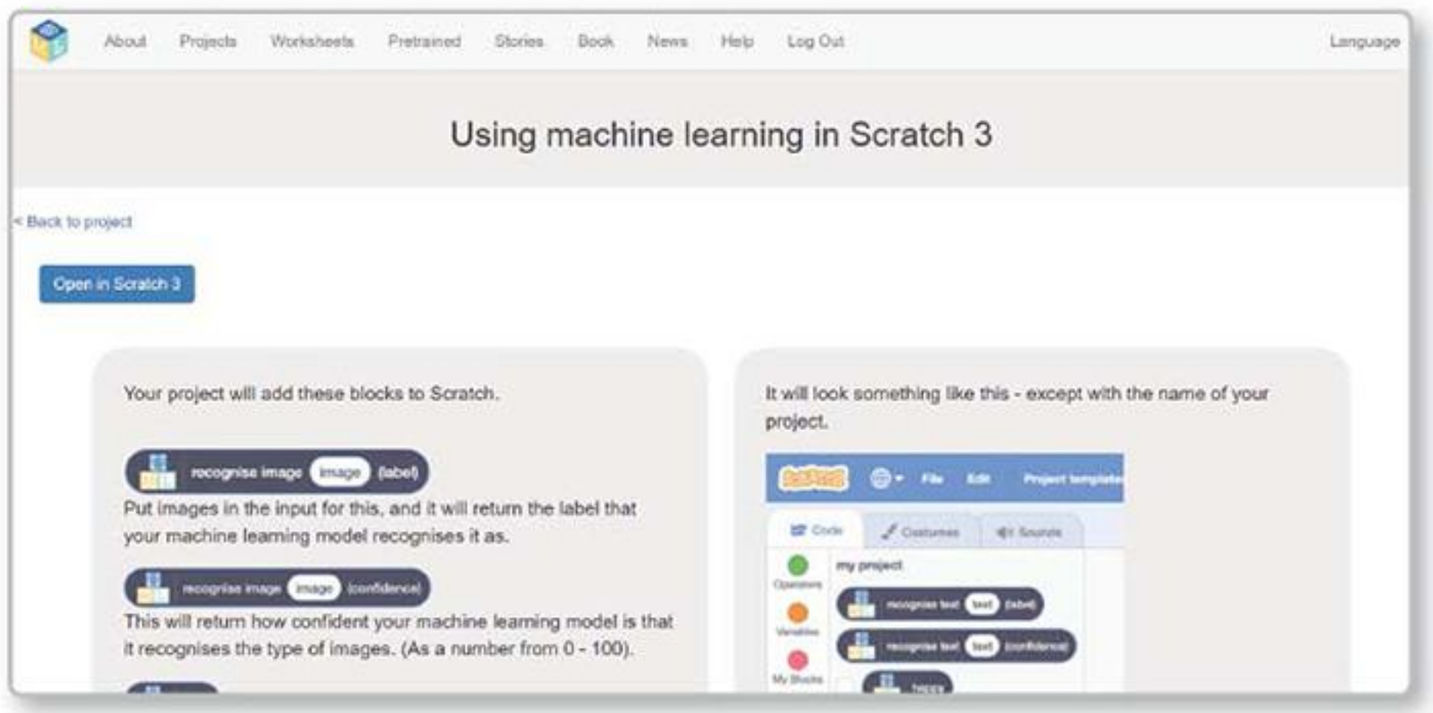
Log Out
Language
"MLforKids"
Train
Collect examples of what you want the computer to recognise
Train
Learn & Test
Use the examples to train the computer to recognise images
Learn & Test
Make
Use the machine learning model you've trained to make a game or app, in Scratch, Python, or App Inventor
Make

For Scratch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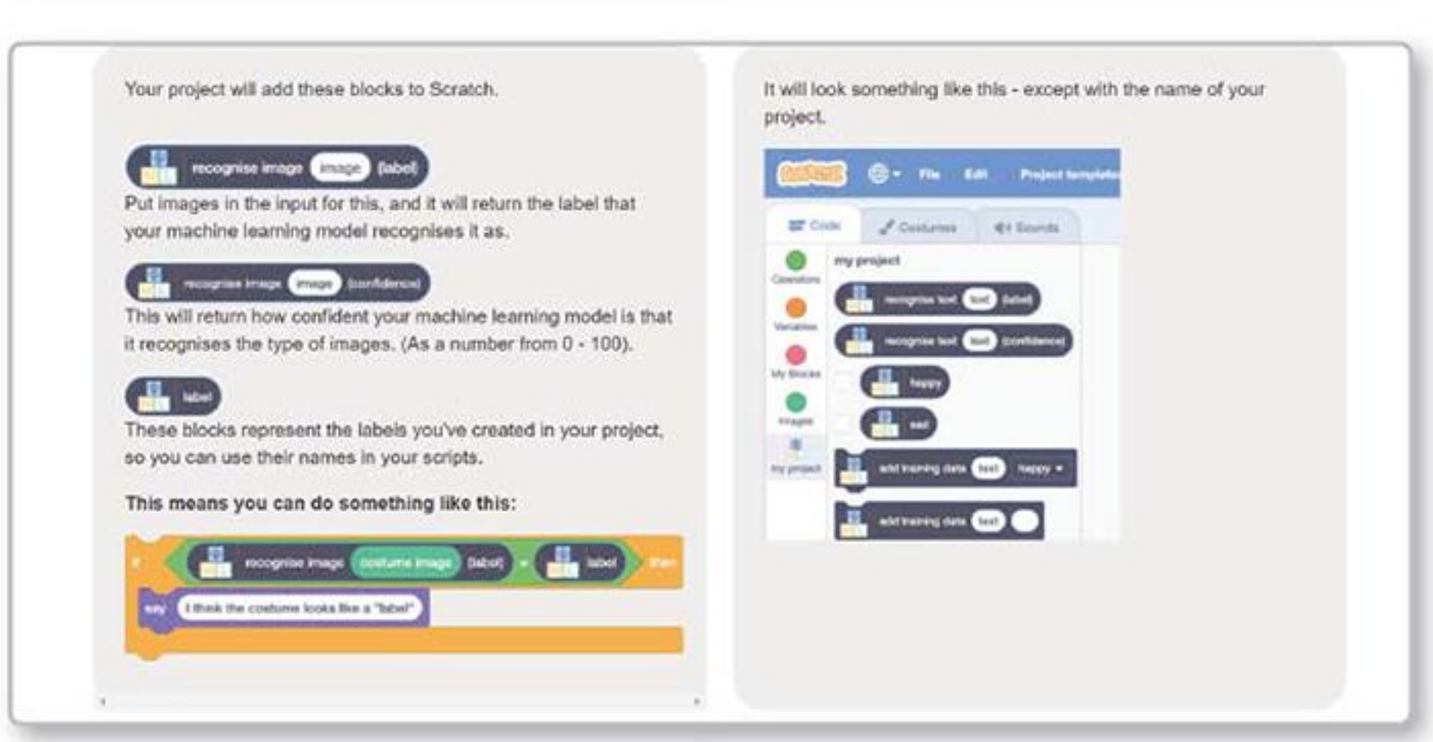
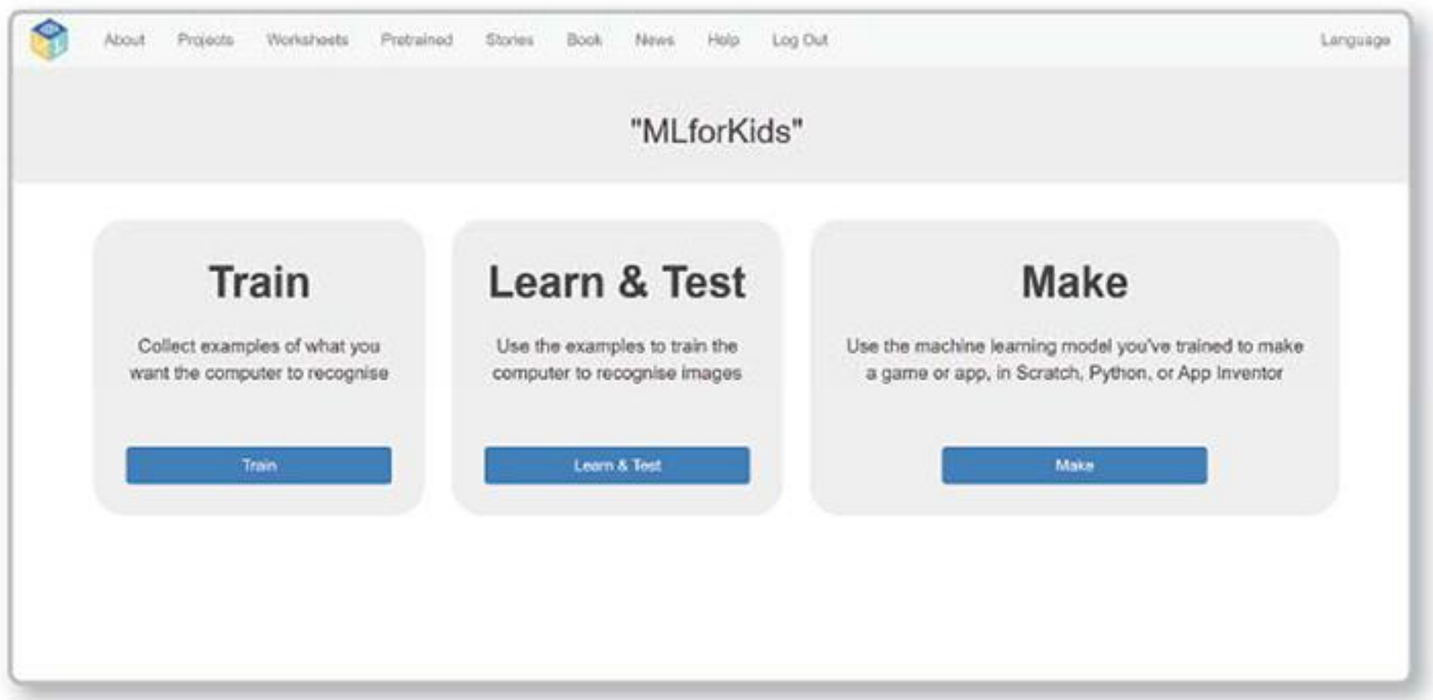
Using machine learning in Scratch 3
< Back to project
Open in Scratch 3
Your project will add these blocks to Scratch.
recognise image image (label)
Put images in the input for this, and it will return the label that your machine learning model recognises it as.
recognise image image (confidence)
This will return how confident your machine learning model is that it recognises the type of images. (As a number from 0 - 100).
It will look something like this - except with the name of your project.
my project


Your project will add these blocks to Scratch.
recognise image image (label)
Put images in the input for this, and it will return the label that your machine learning model recognises it as.
recognise image image (confidence)
This will return how confident your machine learning model is that it recognises the type of images. (As a number from 0 - 100).
label
These blocks represent the labels you've created in your project, so you can use their names in your scripts.
This means you can do something like this:
recognise image costume image (label) = label then
say I think the costume looks like a "label"
It will look something like this - except with the name of your project.
my project
happy
sad
add training data text happy
add training data text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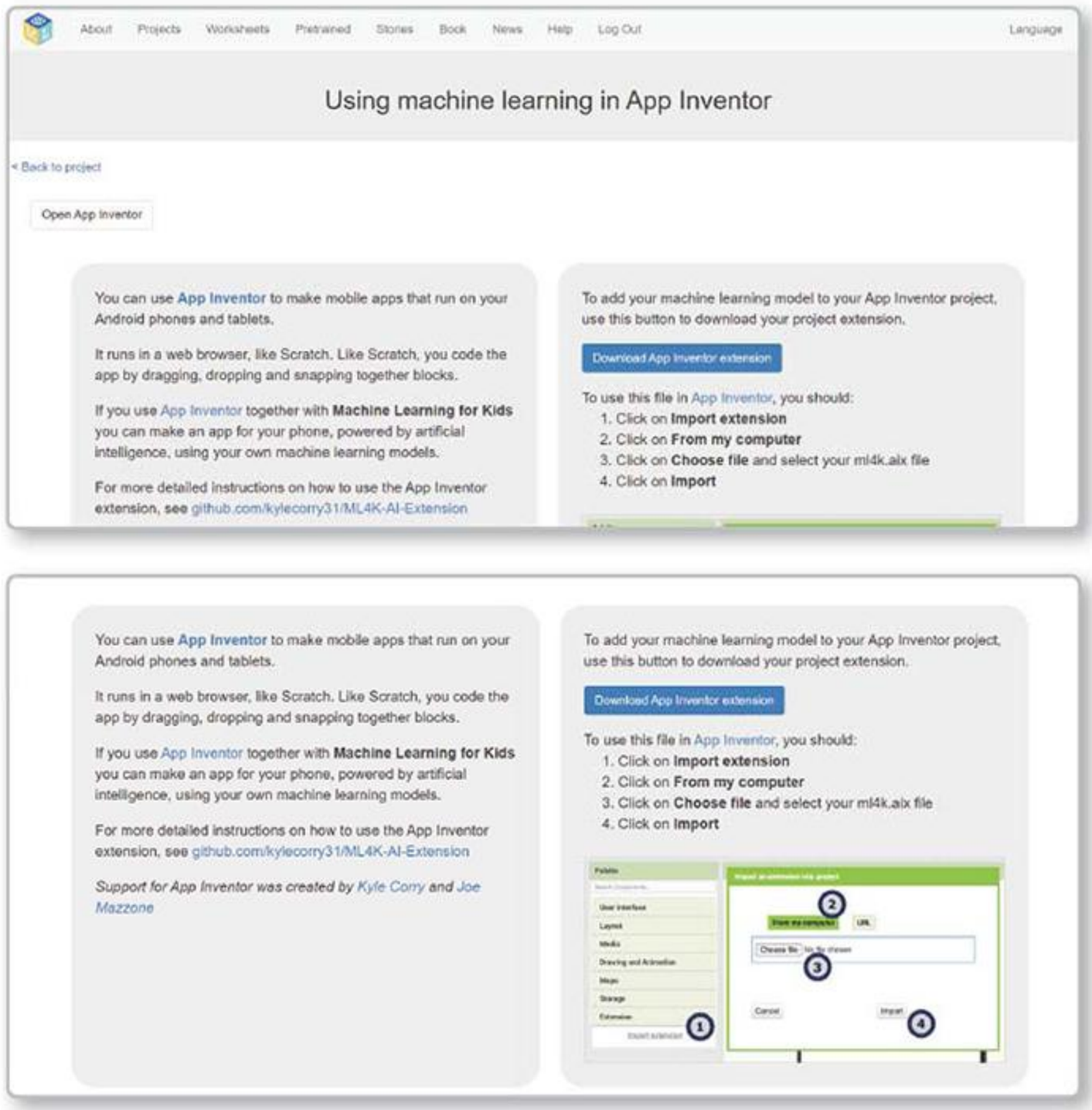
Language
"MLforKids"
Train
Collect examples of what you want the computer to recognise
Train
Learn & Test
Use the examples to train the computer to recognise images
Learn & Test
Make
Use the machine learning model you've trained to make a game or app, in Scratch, Python, or App Inventor
Make

For App Inventor



This is how this site gives you the ability to experiment and experience the machine learning process.

2. **Choose an issue that pertains to the objectives of sustainable development and carry out the actions listed below.** [CBSE]
   - To understand more about the problem identified, create a 4Ws problem canvas.
   - Identify the data features and create a system map to understand relationship between them.
   - Visualize the data collected graphically (Spreadsheet software to be used store and visualise the data).
   - Suggest an AI-enabled solution to it (Prototype/Research Work).

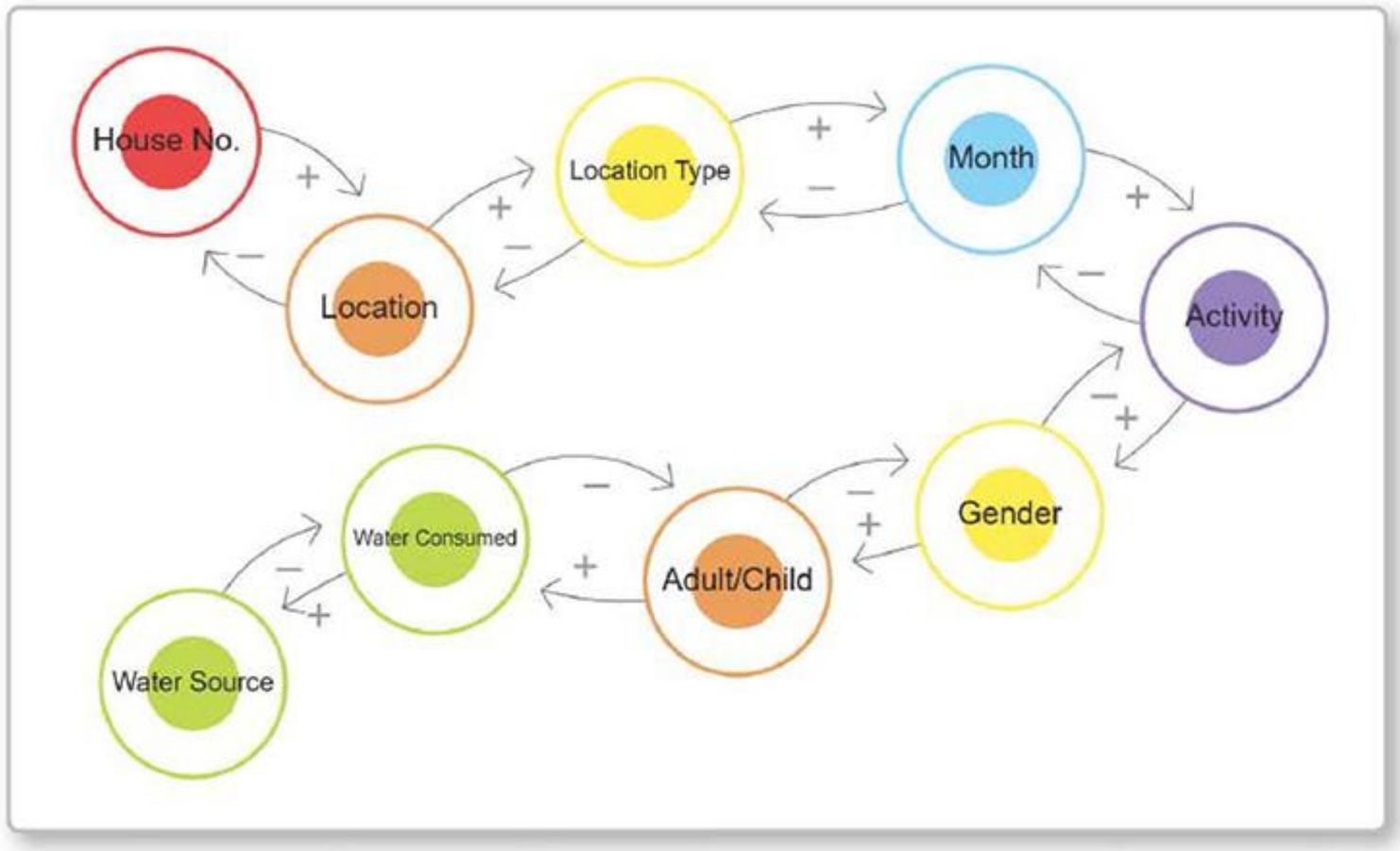
   Issue: Water availability is a major environmental problem in the world. We continue to flush billions of liters of treated fresh water down our toilets every day. Since 40% of the 6 billion people on earth use toilets, it is a lot of water.

   4W Canvas

Our	[stakeholders] People who are facing water crisis	who
have a problem that	[issue, problem, need] There is a need to save water for future, for toilets instead of fresh water there needs to be provision of usage of recycled water	what
while	[context/situation] The problem is "We continue to flush billions of liters of treated fresh water down our toilets every day".	where
an ideal situation would be	[the benefit of the solution to them] A project to redesign the water closet / flush to reduce the consumption of water.	Why

Data Features

For the above problem, the data needed is the average consumption of water in the households for various activities based on Season and Region. The data points would be House No., Location, Location Type (Metro/Urban/Village), Source of water (Piped/Well/Tube Well), Month, Activity, Water Consumed in Liters, Gender, Adult/Child. The sample size from each location should be reasonable enough to represent the location. Location selection needs to be in a way that covers all types of topography like Desert, Plain, Mountain, Coastal Area, Metropolitan, Urban, or Village.



AI Solution

Today in general there is no systematic analysis of water requirement per household and the basis of the supply of water in that area. Today the supply is based on the availability of water in that area to supply. Which creates abundance in some areas, and shortage in others. This thereby leads to gross misuse of this scarce resource available to us in the areas of abundance supply. There is also no use of recycled water in the households as the supply of the same is not there.

To solve the same for our future generations, we need to work on it now and for this things can start by laying down recycled water supply lines to the households to use for washing and in the washrooms for flushing.

This can be started at the places, where already the supply lines are laid, and an AI model needs to be introduced here to manage the supply to different areas based on the household consumption pattern in that area, the kind of area it is, that is Desert would need more water than in the mountains. Gradually, when the water requirements settle down over a period of time, the previous consumption pattern and considering new households added, can also be considered by the AI model to determine the demand.

Further to make the water resources more distributed and available to areas where water is scarce, inter-city supply lines can be laid, and AI model scope can be increased to manage water resources better and more efficiently.

Rohit, an Indian, embarked on a project to redesign the water closet / flush to reduce the consumption of water. He made this possible with a simple mechanism added to the conventional closet that creates a partial vacuum when the user pushes down the flush lever. He called it the Vacu-Flush.

3. **As you know, a Smart Home is a house that has AI-enabled devices like Virtual Assistant, CCTV cameras, GPS tracker and biometric locks. This home is also able to save resources like power and water.**

Now, write any five features that you would like to be the part of a Smart Home. Also, give the reason why you want to add the feature in the Smart Home.

Feature 1- _____

Reason- _____

_____

Feature 2- _____

Reason- _____

_____

Feature 3- _____

Reason- _____

_____

Feature 4- _____

Reason- _____

_____

Feature 5- _____

Reason- _____

_____

4. **It is necessary for autonomous vehicles to understand the behaviour of humans for safe driving. Design a poster to show some of the problems that can be faced while implementing this functionality in autonomous vehicles. After drawing the poster, compare it with your classmates.**

5. **Consider the following dataset that contains 4 parameters to predict whether a lion would be seen or not. The parameters that affect the prediction are: Temperature, Wind, Humidity and Weather. Fill the details in the table given below. One is done for you.**

Temperature	Wind	Humidity	Weather	Lion Seen or Not
Cool	Weak	High	Rain	No

After filling the details, draw a decision tree based on the above dataset.

6. **If you have to create an AI-enabled test paper generator, then write the goals and objectives for the project in space given below:**

Goals:

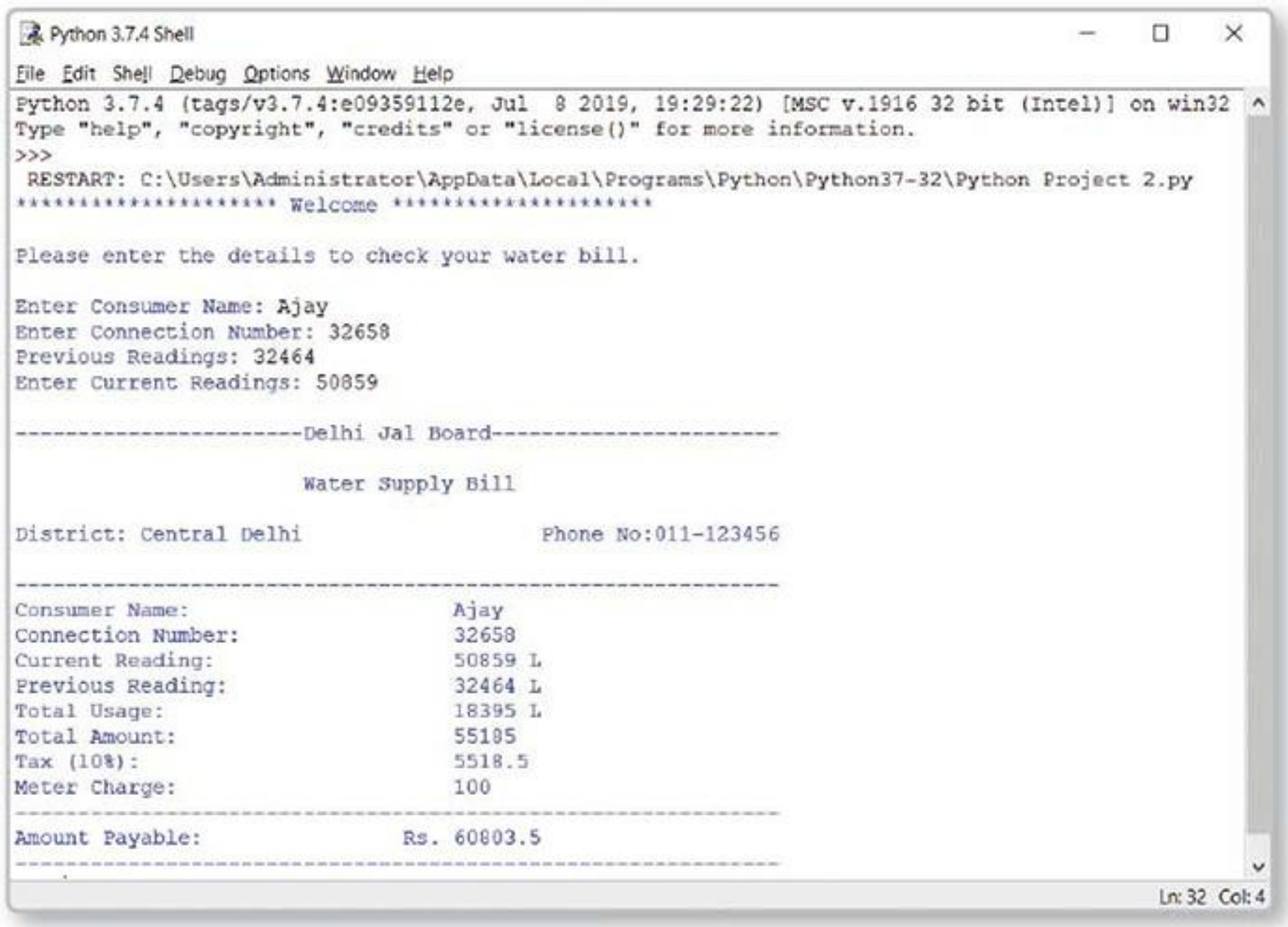
Objectives:

Find the data sources from where you can pick the data to create the project. Write any five sources in the space given below:

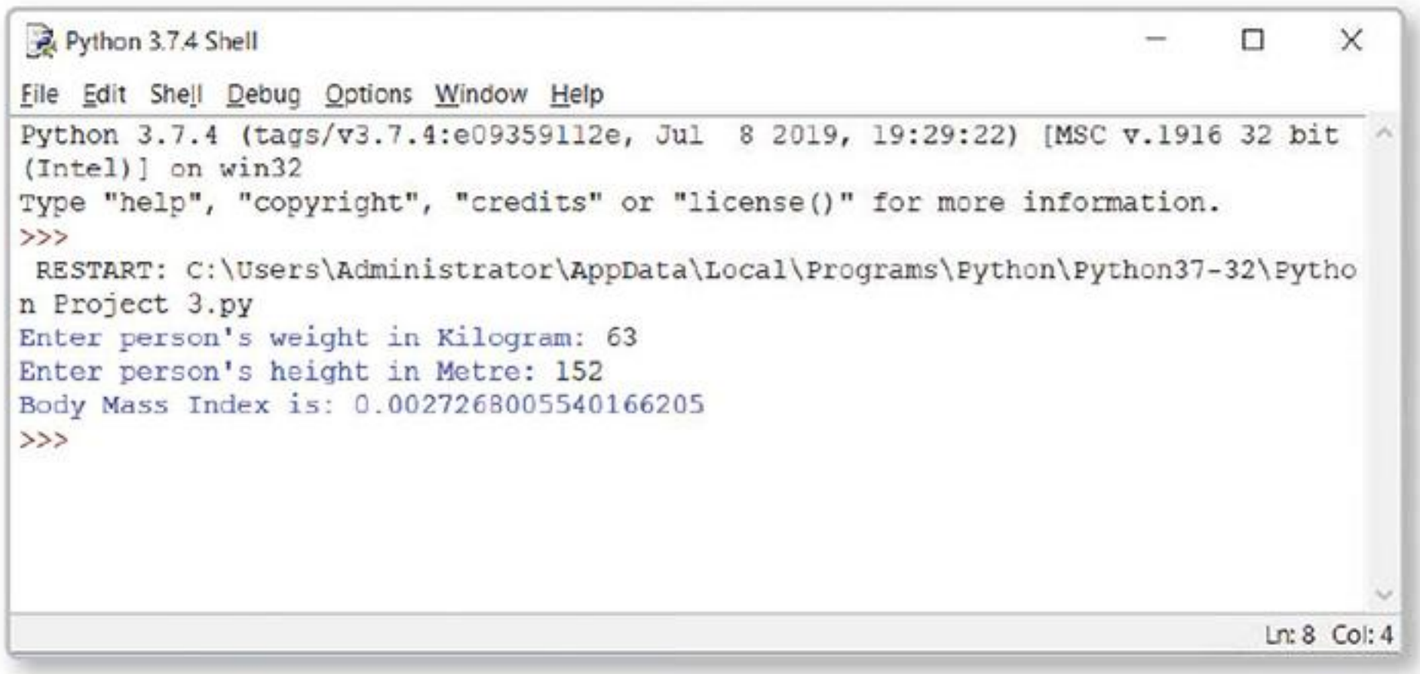
.

7. **Divide the class into groups having 5 students in each group. Each group needs to be creating a presentation on the topic 'Rule-based learning vs Machine Learning'. Write down some of the points here and after creating the presentation, each group needs to be presented in the class.**

8. Write a Python program to generate the following output:



9. Write a Python program to generate the following output:



10. Write a Python program to generate the following output:

Model Test Paper

Time: 2 Hours **Max. Marks: 50**

General Instructions:

1. Please read the instructions carefully.
2. This Question Paper consists of **21 questions** in two sections: Section A and Section B.
3. Section A has Objective type questions whereas Section B contains Subjective type questions.
4. **Out of the given (5 + 16 =) 21 questions, a candidate has to answer (5 + 10 =) 15 questions in the allotted (maximum) time of 2 hours.**
5. All questions of a particular section must be attempted in the correct order.
6. **SECTION A – OBJECTIVE TYPE QUESTIONS (24 MARKS):**
   (i) This section has 05 questions.
   (ii) Marks allotted are mentioned against each question/part.
   (iii) There is no negative marking.
   (iv) Do as per the instructions given.
7. **SECTION B – SUBJECTIVE TYPE QUESTIONS (26 MARKS):**
   (i) This section has 16 questions.
   (ii) A candidate has to do 10 questions.
   (iii) Do as per the instructions given.
   (iv) Marks allotted are mentioned against each question/part.

SECTION A: OBJECTIVE TYPE QUESTIONS

1. Answer any 4 out of the given 6 questions on Employability Skills. **(1 × 4 = 4 marks)**

(i) ..... is the process by which a message is sent by an individual and it passes through a chain of recipients. **1**

(ii) Realistic belief and trust of an individual in one's own judgement, capabilities and worthiness is **1**

(iii) .....refers to a state of handling psychological tension and discomfort originating from unforeseen, difficult, confusing and challenging situations. **1**

(iv) ..... are electronic devices that can hold hundreds of books in digital form. **1**

(v) ..... is the process of identifying an opportunity and turning it into a venture. **1**

(vi) A ..... in an economy is someone who has the ability to affect or be affected by the growth or fall of the economy. **1**

2. Answer any 5 out of the given 6 questions. **(1 × 5 = 5 marks)**

(i) The AI ..... provides us with an appropriate framework which can lead us towards our goal. **1**

a) Stages ◯ b) Problem Scoping ◯

c) Deployment ◯ d) Project Cycle ◯

(ii) AI systems can improve their performance over time through **1**

a) Experience ◯ b) Machine Learning ◯

c) Iterations ◯ d) Project Cycle ◯

(iii) Which of the following is not a step of AI project Cycle? **1**

a) Data Acquisition ◯ b) Modelling ◯

c) Feedback ◯ d) Evaluation ◯

(iv) ..... is an output given by the AI model using Machine Learning algorithm. **1**

a) Result ◯ b) Output ◯

c) Reality ◯ d) Prediction ◯

(v) What will be the outcome, if the Prediction is "No" and it does not match with the Reality? What will be the outcome , if the Prediction is "Yes"and it does not match the Reality. **1**

a) True Negative, False Negative ◯ b) False Negative, False Positive ◯

c) True Negative, False Positive ◯ d. True Positive, False Positive ◯

(vi) Read the examples given below: **1**

i. Using Chat GPT to write an email

ii. Face unlock technology of mobile phones using camera

iii. Turning off lights with IoT device

iv. Hand sanitiser dispenser having sensor

Choose the options that are not AI

a) i and ii ◯ b) iii and i ◯

c) iii and iv ◯ d) i, iii and iv ◯

3. Answer any 5 out of the given 6 questions. **(1 × 5 = 5 marks)**

(i) ..... refers to the ability to read, comprehend and use information effectively. **1**

a) Literacy ◯ b) Data ◯

c) Algorithm ◯ d) AI ◯

(ii) Rearrange the following levels of a Data Pyramid, moving up from the bottom: **1**

a) Data, Information, Knowledge, Wisdom ◯ b) Information, Data Knowledge, Wisdom ◯

c) Data, Knowledge, Information, Wisdom ◯ d) Information, Knowledge, Wisdom, Data ◯

(iii) ..... can equip individuals with skills and knowledge to improvise in a data-driven world. **1**

a) AI ◯ b) Mathematics ◯

c) Data literacy ◯ d) Critical Thinking ◯

(iv) ..... sets a clear roadmap and structured approach to enhance data literacy across different levels of awareness. **1**

a) Talking ◯ b) Discussing ◯

c) Implementing ◯ d) Planning ◯

(v) ..... is the practice of protecting digital information from unauthorised access, corruption, or theft throughout its entire lifecycle. **1**

a) Data Literacy ◯ b) Data security ◯

c) Data Authorisation ◯ d) Data integrity ◯

(vi) ..... refers to the process of creating copies of data to ensure that it can be restored in the event of data loss. **1**

a) Data backup ◯ b) Data privacy ◯

c) Data validation ◯ d) Access controls ◯

4. Answer any 5 out of the given 6 questions. **(1 × 5 = 5 marks)**

(i) _____ is a way for computers to understand and recognize patterns, much like how humans do. **1**

a) Artificial Intelligence ◯ b) Probability ◯

c) Mathematics ◯ d) Data literacy ◯

(ii) Which of the following is not true? **1**

a) AI can learn to recognize patterns, like human beings. ◯

b) AI can see patterns in different types of data - numbers, images, and speech and text. ◯

c) AI cannot think like humans ◯

d) These patterns help AI to solve puzzles – like identifying dogs and muffins, or predicting flood, earthquakes, etc. ◯

(iii) Graph theory is used in AI representing trends using data **1**

a) Analysis ◯ b) Visualization ◯

c) Integrity ◯ d) Privacy ◯

(iv) The design of the ..... often uses mathematical principles and structures such as functions, matrices and graphs. **1**

a) Program ◯ b) Structure ◯

c) Data ◯ d) Algorithms ◯

(v) Statistics can be used in numerous fields because of its ability to extract meaningful insights from data and assist in **1**

a) Algorithms ◯ b) Decision making ◯

c) Pattern ◯ d) Data visualization ◯

(vi) Which of the following is not true for certain events? **1**

a) It will have a probability of 0. ◯ b) These events are guaranteed to happen. ◯

c) It will have a probability of 1. ◯ d) There is no doubt about their occurrence. ◯

5. Answer any 5 out of the given 6 questions. **(1 × 5 = 5 marks)**

(i) AI-generated images are created by AI **1**

a) Patterns ◯ b) Information ◯

c) Algorithms ◯ d) Intelligence ◯

(ii) An unsupervised learning model works on ..... dataset. **1**

a) Labelled ◯ b) Unlabelled ◯

c) Training ◯ d) Continuous ◯

(iii) In Generative Modelling, there is no ..... dataset and the model can generate structured data from the Random Noise dataset. **1**

a) labelled ◯ b) Trained ◯

c) Random ◯ d) Unlabelled ◯

(iv) A ..... dataset typically refers to a collection of data points or samples where each data point is generated randomly. **1**

a) random ◯ b) random noise ◯

c) disarranged ◯ d) Human generated ◯

(v) ..... AI is trained with existing data and content. **1**

a) Weak ○ b) Strong ○

c) Latest ○ d) Generative ○

(vi) ..... are neural networks that work to produce fresh data and is made up of two neural networks. **1**

a) GANs ○ b) Gen AI ○

c) VAEs ○ d) Autoencoders ○

SECTION B: SUBJECTIVE TYPE QUESTIONS

Answer any 3 out of the given 5 questions on Employability Skills. **(2 × 3 = 6 marks)**

6 Mention any 2 advantages of written communication.

7 Mention any 2 benefits from self-management. **2**

8 What is an operating system? Give 2 examples of an operating system. **2**

9 Mention any 2 challenges of entrepreneurship development. **2**

10 State any 2 basic components of a Green Economy. **2**

Answer any 4 out of the given 6 questions in 20–30 words each. **(2 × 4 = 8 marks)**

11 All of us use smartphones. When we install a new app, it asks us for several permissions to access our phone's data in different ways. Why do apps collect such data? **2**

12 If you do an image search for vacations on a popular search engine, the first few searches mostly return the picture of beaches. What is the concern here? Explain. **2**

13 After reaching home, Ankit realised that he had left his laptop in the cab. What should have he done in order to secure his data? Explain. **2**

14 If you randomly select a card from a standard deck, the probability of drawing an ace of spades is lower compared to drawing a card of a different suit.

Which category of the events in the above scenario falls? What shall be its probability? **2**

15 What is Variational Autoencoders (VAEs)? **2**

16 What are Generative AI tools? Give any two examples. **2**

Answer any 3 out of the given 5 questions in 50–80 words each. **(4 × 3 = 12 marks)**

17 Samarth attended a seminar on Artificial Intelligence and has now been asked to write a report on his learnings from the seminar. Being a non-technical person, he understood that the AI enabled machine uses data of different formats in many of the daily based applications but failed to sync it with the right terminologies and express the details. Help Samarth define Artificial Intelligence, list the three domains of AI and the data that is used in these domains. **4**

18 Your grandmother watches, you use AI applications. She wants to understand more about it. Help her understand the term artificial intelligence by giving the right definition and explain to her with an example how machines become artificially intelligent. **4**

19 How are Data Security and Data Privacy related to AI? **4**

20 Probability has a wide range of applications across various fields, making it an essential concept in many areas of study and professional practice **4**

21 Amber attended a seminar on AI conducted by college representatives. She had to write a report on "AI-Integrated Learning" for her school magazine. Suggest some AI tools that can help her to do the same. **4**

AI GLOSSARY

- **Algorithm:** It is a step-by-step approach to identify and solve a problem in a finite time.
- **CodeCombat:** It is a free coding educational game that teaches you to learn JavaScript or Python coding in a fun way.
- **Control Structures:** Control structures are a set of instructions that controls the flow of instructions in a program.
- **Data Acquisition:** It means collecting raw data for the purpose of reference or analysis for the project.
- **Data Visualization:** It is an easier way to understand the trends and patterns in data by using graphical representation tools like charts and graphs.
- **Data Modeling:** It is the process of designing decision-making algorithms that has to be trained on a set of data and apply that learning to recognise certain types of patterns.
- **Deep Learning:** It is a machine learning algorithm that is inspired by the functionality of our brain cells called neurons.
- **Decision Trees:** These are the tools that follow a rule-based approach that uses a tree-like model of decisions and their possible consequences.
- **Flowchart:** A flowchart is a graphical representation of an algorithm that makes use of symbols which are connected through arrows to show the direction of flow of information.
- **Human-Machine Interaction (HMI):** It can be defined as the communication or interaction between humans and machines through a user interface to fulfill a specific task or operation.
- **Intelligence:** It is the ability to learn from experience, to recognise problems and to solve problems.
- **Variational Autoencoders (VAEs):** A variational autoencoder (VAE) is a generative AI algorithm that uses deep learning to generate new content, detect anomalies and remove noise.
- **Python:** It is a general-purpose, object-oriented, easy-to-learn and high-level programming language.
- **Virtual Assistant:** It is an application that we use to control our smart home is a prime example of AI impacting our daily lives.

AI Innovators

Richard Socher

Richard Socher is a German national who was born in Palo Alto, California. He has been described as "one of the prodigies of the artificial intelligence and deep learning space". His technologies are transforming natural language processing and computer vision by enabling a better understanding of context and sentiment.

Elon Musk

Elon Reeve Musk is an entrepreneur and business magnate. A centibillionaire, Musk is one of the richest people in the world. In 2002, Musk founded SpaceX, an aerospace manufacturer and space transport services company, of which he is CEO and CTO. In 2004, he joined electric vehicle manufacturer Tesla Motors, Inc. as chairman and product architect, becoming its CEO in 2008. In 2006, he helped create SolarCity, a solar energy services company that was later acquired by Tesla and became Tesla Energy. In 2015, he co-founded OpenAI, a nonprofit research company that promotes friendly artificial intelligence.